NATURE WATCH

Official Magazine of Nature Society (Singapore)

Volume 17 No 3 Jul-Sep 2009

Featuring:

Froggy Friends

Gurney's Pitta

Baya Weavers

Cyrene Reefs

Galapagos

NATURE SOCIETY
(SINGAPORE)
MICA (P) 225/07/2009

Message from Editor

When I took over as editor of *Nature Watch* in June 2009 my first priorities were to catch up with the backlog of issues and research content, as well as co-ordinate with a new production crew. The not-so-envious task of finding someone to do proofreading and style editing of language became second priority; I simply couldn't find anyone within the society to help me on such a short notice.

So, for the first three issues, Volumes 16/4, 17/1 and 17/2, I sent my edited text to my son Daniel, who is a student of English at Aarhus University in Denmark. The next morning I would always have the cleaned file back in the mail. But even though the system worked well for me, it wasn't quite right. Remember what happened to the President of France Nicolas Sarkozy when he made use of his son at work? Nepotism accusations flew around fast and furious. To preempt that, I needed someone within the society with distinguished language skills, as well as knowledge about NSS matters and Asian nature in general.

Now we have found such a person. Honorary Secretary Margie Hall has involved herself in *Nature Watch* from the start, and rather than have her nitpick on the issues after they are printed, as Assistant Editor she will now have a better chance to nitpick BEFORE the presses roll. Please welcome Margie to the NW team and feel free to approach her with comments and ideas. Sorry, my mistake, I have to label her Acting Assistant Editor to underline the non-permanent role of her involvement.

Photo: XXXXXXXXXX

When not hitting the English books, Daniel likes to go for a stroll. Here he walks past th....

Filename was cut off

For this issue we have a strong lineup of qualified and capable contributors. All are talented and experienced nature photographers as well as knowledgeable writers, so both the visual and textual content will have a lot of impact this time around.

Leong Tzi Ming is a gifted all-round zoologist, and in this issue he covers his special interest in frogs, while Tan Gim Cheong travels to southern Thailand to check on the current status of the most wanted bird in the country. Con Foley shares with us his new amazing action photos while studying the nesting habits of the Baya Weavers in Singapore; particularly appropriate now that this species adorn the back cover of the magazine. Ria Tan might be well-known by most members of the NSS, but even then, her material from Cyrene Reef is fresh and significant. I bet many readers still didn't know of this exceptional coral habitat so close to the harbour. After a visit to Galapagos, Bjorn Olesen reflects on these special islands as a case-story for eco-tourism.

Morten Strange
Editor-in-chief
December 2009

Share with us

Your stories, articles, surveys, observations and brilliant photographs and send them to the address on page 1. If you are not sure, please send an e-mail to contact@nss.org.sg with a proposal and we will get back to you. Articles can be e-mailed across as a simple Word document (no funny fonts or colours or inserts, please) or saved on a CD and mailed with the illustrations as separate high res. files. Digital pictures must be in 300 dpi, absolutely sharp and as large as possible, jpeg compression is OK. Do NOT crop, brighten or sharpen, we will do all that as necessary. Thank you very much.

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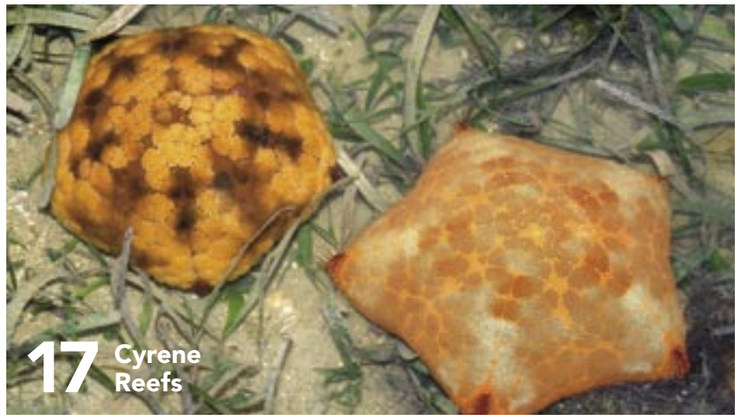

ON THE COVER Spotted Treefrog (*Nyctixalus pictus*) Photo by Leong Tzi Ming

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Facing the Future with our Froggy Friends

Text and photos by **Leong Tzi Ming**

For Leong Tzi Ming, frogs are his first love. In this account he reveals how he became enamoured of amphibians and why we need to save them. As an excellent photographer as well as a scientist, he also shows us some of his intimate studies of frogs from Singapore and Malaysia.

Face to face with a superbly camouflaged Thorny Treefrog (*Theloderma horridum*) at Bukit Timah Nature Reserve back in March 1996, it suddenly dawned upon me that this species had never been previously recorded in Singapore! Shortly after, it was officially recognised as the fourth species of Treefrog (Family Rhacophoridae) for Singapore's amphibian checklist (Leong et al., 1996). As a result of sustained field research in our forests, yet another frog species, *Microhyla borneensis* was added to the list in the following year (Leong & Chou, 1997). To have found two new frogs consecutively was indeed a bonus for Singapore's biodiversity, and encouraged me to commit more of my time and energy to researching our indigenous amphibians in order to save them. Additionally, my fascination with the morphology and metamorphosis of tadpoles has led me to channel my research efforts locally in Singapore and neighbouring Peninsular Malaysia (Leong & Chou, 1999; Leong, 2004).

However, in the last decade, I have also been privileged to be exposed to the tremendous diversity of amphibians and reptiles beyond Singapore's shores. While participating in biological monitoring and inventory surveys, or being kindly hosted by herpetological friends in the region, I have had opportunities to become acquainted with the various frog fauna of Malaysia, Indonesia, Thailand, Vietnam, Laos, Philippines, Sri Lanka and also Australia. Getting my hands and feet wet in the streams and swamps of these countries has allowed me to see eye to eye with their endemic frog species, and I cannot ignore the worry in those bulging eyes – a fear that their days on earth may be numbered.

International frog focus

As some of us might recall, 2008 was officially declared the 'Year of the Frog', a conservation cause promoted by the Amphibian Ark, with support from the Amphibian Specialist Group (ASG). This yearlong event was a response to the reports of scientists of the simultaneous decline and disappearance of various frog species all around the globe in the last two decades.

Among the vertebrate groups, the amphibians have often been regarded as one of the organisms most vulnerable to being severely affected by excessive disturbance to their habitat or environment. A combination of factors may spell further trouble for our remaining froggy friends, and these can be summarised into the 6 C's: (1) Climate Change, (2) Chytrid Fungus, (3) Collection from the Wild, (4) Competition from Invasive Species, (5) Constriction of Existing Habitats, and (6) Contamination of Pristine Environment (Leong, 2008).

Curse of the six C's

First and foremost, the ill effects of climate change presents a serious threat to the livelihood of numerous amphibians, whose survival and reproduction are intimately reliant upon local and regional weather patterns. Any drastic deviation from the once predictable seasonal rains may throw their breeding patterns out of synchrony. In addition, the predicted trends of global warming would push many species of montane amphibians closer the edge of extinction, as their preferred requirements of cool, moist rainforests are systematically restricted to the highest summits. One example of such a potentially endangered species is the Mountain Range Frog, *Rana banjarana*, which lives up in the highlands of Peninsular Malaysia and southern Thailand (Leong & Lim, 2003). Secondly, the discovery of a lethal frog fungus, *Batrachochytrium dendrobatidis* (or Bd in short) has made us aware of how quickly it can infect local populations by entry through the permeable skin and affecting its physiology and nervous system. Thirdly, over-

Spotted Treefrog (*Nyctixalus pictus*)

Spotted Stream Frog (*Rana signata*)

Banded Bullfrog (*Kaloula pulchra*)

Black Spotted Sticky Frog (*Kalophrynus pleurostigma*)

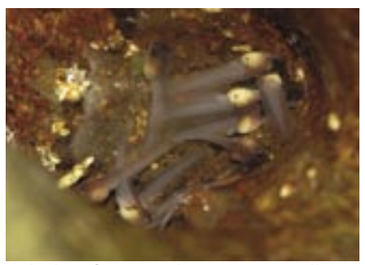
Common Greenback (*Rana erythraea*)

Puddle Frog (*Occidozyga laevis*)

Copper-cheeked Frog (*Rana chalconota*)

Frogs_Golden-eared Rough-sided Frog (*Rana baramica*)

Rhinoceros Frog (*Limnonectes plicatellus*)



Tadpoles of Saint Andrew's Cross Toadlet (*Pelophryne signata*)

Tadpole of Common Treefrog (*Polypedates leucomystax*)

Tadpole of Malayan Horned Frog (*Megophrys nasuta*)

harvesting of certain frog species from wild stock for either food or the pet trade can actually deplete resident populations at a faster rate than they can replenish themselves.

The fourth factor may present itself in the form of an alien species of frog or toad which competes head-on with the native species for a similar niche in a restricted habitat. The classic case study of the erroneous attempt at biological pest control in the form of the Cane Toad, *Bufo marinus* is one example of the dangers of alien species. A seemingly 'harmless' crate of Cane Toads was first landed on the shores of Queensland, Australia in 1935, in the hope that they might be able to eradicate the insects that plagued the sugarcane plantations. In time, this innocent idea multiplied into nightmarish proportions, as Australians witnessed the aggressive march of these toads northwards to Darwin and southwards to New South Wales! In their invasive wake, many species of local frogs were both gobbled up and shoved aside.

Accompanying ever-increasing anthropogenic activities such as road and highway construction, existing habitats for frogs may be continually fragmented, thus isolating populations and reducing the chances of healthy genetic exchange. Exacerbating this threat are the potential risks of environmental contamination of the air and water, both of which have direct impacts on the welfare of amphibian communities.

Amphibian attention globally ....

With such a compilation of fearful factors threatening the long term survival of frogs around us, is it any wonder that scientists and nature lovers around the world have joined forces to be the voice for frog species conservation in their respective countries. For example, the critically endangered Lemur Leaf Frogs (*Hylomantis lemur*) of Central America have been adopted by Zoo Atlanta (Georgia) for captive breeding efforts (Holland, 2009). In Madagascar, at least 80 different frog

Despite our small size and limited habitats, Singapore is still home to 25 species of amphibians and considerable effort has been taken to monitor the health of our local frog populations.

Harlequin Treefrog (*Rhacophorus pardalis*) from Borneo

Mating pair of Torrent Frogs (*Meristogenys sp*) from Borneo

Malayan Horned Frog (*Megophrys nasuta*)

Malesian Frog (*Limnonectes malesianus*)

I didn't use the 2 frog logos - is that OK?

species have been tested for the chytrid fungus, and thankfully, the results have been negative (Jackson, 2008). In Australia, research techniques included radio-tracking of the Stony Creek Frog (*Litoria lesueuri*) in the Wet Tropics of Queensland (Connellan, 2006).

.... and locally

Despite our small size and limited habitats, Singapore is still home to 25 species of amphibians and considerable effort has been taken to monitor the health of our local frog populations. As the majority of native frogs are confined to the remnant central forests, much time has been invested to determine the distribution and breeding patterns of the forest frog species. Of particular interest are target species which are highly localised, with relatively small population sizes. One such example is the Saint Andrew's Cross Toadlet (*Pelophryne signata*), which has only been found in Bukit Timah Nature Reserve thus far. Nevertheless, we were delighted to witness signs of recent breeding for this species (Leong & Teo, 2009). Its utilisation of treeholes (phytothelms) as microhabitats for tadpole development points to the importance of minimal rainfall to ensure that such treeholes are sufficiently filled up with water. Any prolonged dry spell would deprive any arboreal species of breeding opportunities and nursery spaces for their progeny.

In the preceding decades, the forest at Bukit Timah Nature Reserve has transformed at a pace that has surprised us as much as it has saddened us. One major change is the noticeable decline in the flow rate and volume of certain hill streams. These streams are vital to the survival of most amphibian species. Other factors, which are invisible, but equally crucial, are the components of the water quality – pH, dissolved solutes, dissolved oxygen, etc. If frogs are truly the sensitive bio-indicators that they are reputed to be, then we should listen carefully indeed and tune in to what message is being conveyed. If the frogs are signaling the onset of undesirable environmental or climatic alterations, then let us waste no time in reversing the trend and create a more promising future for all of amphibian-kind and humankind.

Malayan Giant Frog (*Limnonectes blythii*) guarding eggs

Acknowledgements *I am grateful to Prof. D. H. Murphy, Lua Hui Kheng and R. Subaraj for sharing their personal accounts of the microclimatic trends that they have witnessed at Bukit Timah Nature Reserve in the last few decades. Sincere appreciations also to HSBC (Singapore) for their constant support and partnership in conserving our native biodiversity and sharing our concerns on the consequences of climate change to our local wildlife.*

Dr. Leong Tzi Ming *has been hot on the heels of frogs in Singapore and the region since his undergraduate days at the National University of Singapore. Since then, he has also looked after penguins at the Bird Park and giraffes at the Night Safari. Ultimately, he still finds field research most gratifying. He is currently spearheading faunal surveys at the Central Nature Reserves in order to document our rainforest biodiversity and determine the possible effects of climate change on the long-term survival of fauna in remnant habitats.*

REFERENCES

Connellan, I. (2006) The Frog Whisperer. *Australian Geographic*, (Jan-Mar): 94–99.

Holland, J. S. (2009) Race to save the frogs. *National Geographic*, 215(4): 138–153.

Jackson, T. (2008) Year of the Frog – jumping into action. *Africa Geographic*, 16(10): 52–57.

Leong, T. M. (2004) Larval descriptions of some poorly known tadpoles from Peninsular Malaysia (Amphibia: Anura). *Raffles Bulletin of Zoology*, 52(2): 609–620.

Leong, T. M. (2008) Alert: our Frog Friends may all Croak. *The Straits Times*, Singapore (Saturday, January 5th 2008), pp. S10–S11 (Science column).

Leong, T. M. & L. M. Chou (1997) New record of the narrow-mouthed frog, *Microhyla borneensis* Parker (Amphibia: Anura: Microhylidae) from Singapore, with taxonomic notes and larval description. *Raffles Bulletin of Zoology*, 45(1): 97–103.

Leong, T. M. & L. M. Chou (1999) Larval diversity and development in the Singapore Anura (Amphibia). *Raffles Bulletin of Zoology*, 47(1): 81–137.

Leong, T. M. & B. L. Lim (2003) A new species of *Rana* (Amphibia: Anura: Ranidae) from the highlands of the Malay Peninsula. *Raffles Bulletin of Zoology*, 51(1): 115–122.

Leong, T. M. & S. C. Teo (2009) Endotrophic tadpoles of the Saint Andrew's Cross Toadlet, *Pelophryne signata* (Amphibia: Anura: Bufonidae) in Singapore. *Nature in Singapore*, 2: 21–25.

Leong, T. M., B. Y. H. Lee & L. M. Chou (1996) New record of the Tree-frog, *Theloderma horridum Boulenger* (Amphibia: Anura: Rhacophoridae) from Singapore. *Raffles Bulletin of Zoology*, 44(2): 475–477.

Gurney's Pitta

Text and photos by **Tan Gim Cheong**

Tan Gim Cheong goes looking for the most wanted bird in Thailand, and in the process he provides an update on the current status of this endangered species.

For years the Gurney's Pitta was hovering close to being declared officially extinct. For more than 30 years after 1952 there were no field observations. Then in 1986 a rediscovery took place, at a lowland rainforest reserve in Southern Thailand, Khao Nor Chuchi (KNCC). Initially the population was estimated at 44-45 pairs, but it fell subsequently to a low of 24 birds in 2000, and BirdLife International categorized the species as Critically Endangered with global extinction. This decline happened despite ongoing conservation efforts, and was largely blamed on deforestation and human pressures on the forest.

Much has been written about this iconic species since then. In fact, Lim Kim Seng provided an excellent account of his trip to see the bird in 2001 in the Volume 9 No 4 issue of *Nature Watch*. If you can find this issue, his detailed story is still worth a read.

But happily the bird's status began to change yet again after 2000. Most significantly, in 2003 more sites were discovered during field surveys in nearby

The most wanted bird in Thailand Gurney's Pitta *Pitta gurneyi*, here seen from Yotin's hid.jpg ??????

Southern Myanmar. It was found that the Gurney's Pitta persisted at four sites with a maximum of 10-12 pairs at one location. In view of this, and the fact that the species can survive in secondary forest and disturbed forest edges, it was down-listed in 2008 to *Endangered* with global extinction. Now, the latest population estimate for Thailand is between 15 and 20 territories, according to Birdlife Indochina. And the Myanmar population, extrapolating across suitable habitat using known densities, is estimated to be between 9,300 and an astonishing 35,000 territories, although it probably lies around a mid-point of 20,000 territories. Recent research in Myanmar also showed that the species there occurs further north than previously thought, and at higher altitudes (see http://www.birdlife.org/datazone/species and a recent study on http://www.birdlife.org/news/news/2009/10/gurneys_pitta.html for details).

However, eco-tourism access to these new areas in Myanmar was and still is difficult. Thus, for practical reasons, KNCC is the only site for birders seeking to see this beautiful bird. Today, this is regarded as the Most Wanted bird by birdwatchers in Thailand, if you want to believe Nick Upton's survey on Thaibirding.com. It is closely followed by the Spoon-billed Sandpiper, a scarce but widespread migrant that you could even be lucky enough to find in Singapore. You can check http://www.thaibirding.com/news/toptenresults1.htm for a complete list of the Top 10 most wanted birds in Thailand.

In view of all this, I decided to visit KNCC to see the Gurney's Pitta for myself, mainly in case its population went into reverse again and totally collapsed! Felix Wong and I flew into Phuket and drove to KNCC. On the way we stopped at Phang Nga Mangroves Park just outside Phang Nga town and braved a drizzle. When the rain stopped we soon laid our eyes on 2 Mangrove Pittas in the little patch of mangroves. Although it looks similar to the Blue-winged Pitta, this species has a bill that is much larger. As the birds moved about from the ground to the middle levels of the mangroves, we were treated to all round views of the multitude of colours of the bird. The green feathers on its wings were particularly intricate and its rump was a most attractive shade of radiant blue.

The next morning, we were at KNCC and went to Trail B to try our luck. Here, we bumped into a male Banded Pitta feeding quietly on the trail. The vegetation all around was quite thick and by being on the trail, the bird offered us very good views as it searched for its breakfast. We were

As the birds moved about from the ground to the middle levels of the mangroves, we were treated to all round views of the multitude of colours of the bird.

Mangrove Pitta *Pitta megarhyncha* at Phang Nga Mangroves.

pleased as it was our second pitta in as many days!

The other birds were less cooperative and it was difficult to locate calling birds amongst the thick vegetation. A Rufous-collared Kingfisher called and as we tried to get nearer, the bird shot off in a blurred flurry of feathers. It was nice to see Green Broadbills but there were no signs of Gurney's Pitta. As midday approached, we visited the Emerald Pool. The water was shallow and crystal clear. The midday warmth made the waters all the more inviting and we soon regretted not bringing a change of clothes!

In the late afternoon, we visited U Trail, the traditional stakeout for Gurney's Pitta. Along the trail, we had good views of an Orange-breasted Trogon. This time round, I thought we heard a single call from a Gurney's Pitta, but the call was not repeated, and the vegetation was too dense to bash into.

On the third day, we tried Trail B again and staked out a gully off the trail where there were previous sightings of the pitta. Another birder joined us and the three of us sat on a slope overlooking the gully. There wasn't even a call from our target bird, so Felix decided to check out the nearby Trail C. In the meantime, a Red-throated Barbet came foraging and a Moustached Hawk-Cuckoo flew in. This secretive cuckoo is rather difficult to see and here it was right in front of me!

The best period to see the birds appears to be from February to April judging from the various trip reports. This is the dry season, when the birds tend to frequent the same spots for food.

We were not alone at KNCC. There seemed to be a steady stream of birders, judging from our observations while we were there and from trip reports. Apart from birders, other tourists include those who just want to go relax at the Emerald Pool. The Emerald Pool is very popular with the Thais.

The afternoon was spent at Krabi, where we had lunch on a stilt restaurant by the seaside and did some birding at the Krabi Mangroves Park. We found a rather shy Ruddy Kingfisher and again, Mangrove Pittas gave away their presence with their calls and we soon located one. For us, the star of Krabi Mangrove Park was the Brown-winged Kingfisher. It looked smart in its two-tone buff-chocolate plumage with bright red bill and feet, completed with a brilliant blue rump.

But we still had not found what we came for. By consulting the bird log at the Morakot Resort, we realized that most birders located the Gurney's Pitta by employing the local guide Yotin Meekaeo. This was the same guide that Kim Seng had used in 2001! Since we hadn't had much luck on our own, we hired Yotin for our fourth day, our last at the resort. The best period to see the birds appears to be from February to April judging from the various trip reports. This is the dry season, when the birds tend to frequent the same spots for food, whereas in the wet season from May to September, food is more widely available and the birds more difficult to locate.

Female Gurney's Pitta *Pitta gurneyi* at Khao Nor Chuchi.

Our little chalet at The Morakot Resort.

Brown-winged Kingfisher *Halcyon amauroptera* at Krabi Mangroves Park.

The entrance to Trail B at Khao Nor Chuchi.

So, the next morning, with the help of our guide, we enjoyed prolonged views of a pair of Gurney's Pitta from a hide. The hide was built near a termite nest where the birds came regularly to feed during the dry season. There was no tape-playing nor 'artificial' feeding. One of the birds was ringed. I later contacted Dr. Philip Round about this, but he wasn't the one who had ringed the bird. I don't know who did, but there are conservation programmes in the reserve, and the project managers do catch and study the pittas.

As the birds fed, they moved about giving us front, back, side and head-on views. With such good views, we could see clearly why this species is also known as the Black-breasted Pitta. This is due to the extensive black patch down the male's breast. The female's colours were less contrasting, but she was beautiful in her own right all the same. We left Khao Nor Chuchi pretty satisfied that we had such good views of this endangered bird, and that we had seen a pitta every day!

***Tan Gim Cheong** is an avid birder/photographer with a keen interest in South-east Asian avifauna.*

COMPETITION RESULTS

What species is this?

Conclusion compiled by Morten Strange

THIS photograph featured in *Nature Watch* Volume 17/2 illustrates the tricky issue of field identification of the two species of mousedeer that occur in Singapore and Malaysia. I selected this photograph because it shows an animal in the open, in strong natural light, recorded on Kodachrome 64 film with no digital manipulation. Even then, identification (ID) is not easy! I took this photo 20 years ago, in October 1989 at the Singapore Zoo. I have never photographed a mousedeer in the wild, although I have seen a few in places like Panti Forest Reserve and Taman Negara National Park. The exhibit at the time near the reptile enclosures was labeled Lesser Mousedeer, so I submitted the slide to my agent in the UK, NHPA, as such. I later noticed that they changed the ID for their files to Greater Mousedeer. And they were right, that is what it is!

The competition exercise was a flop. Not a single reader e-mailed the society to dare a guess to the ID, let alone a description and explanation. So, we saved the prize we had promised, a copy of *Wild Animals of Singapore* by Nick Baker and Kelvin Lim.

But let us provide the solution to the mystery anyway. Kelvin Lim, Curator with the Raffles Museum of Biodiversity Research, also viewed the photograph, and he comments:

The picture shows a Greater Mousedeer, but a different subspecies from those photographed on Pulau Ubin and featured in Nature Watch *Vol. 17/2. The stock kept and bred at the Singapore Zoo is the reddish/orange form that is found on islands such as Pulau Tioman and the Riau Islands, and currently referred to as* Tragulus napu rufulus. *It is a Greater because there are two white stripes on the side of the neck (usually only one on the Lesser), and because the ears and legs are black (brown in the Lesser and mainland Greater –* T. napu napu*). Plus, there is a black line from the nose to the eye and the ear, and the upper lip is also black (this feature is not seen on the Lesser and mainland Greater). The dorsal colour is bright orange while Lesser tends to be rich brown (mainland Greater is dull yellowish-brown like those in the article). I can't quantify this, but Greater Mousedeer tends to be more compact in appearance. The presence of long canine tooth (tusk) shows a male individual.*

When identifying from a 'perfect' image like this is so difficult, imagine what species ID would be like from a fleeting glimpse during a night survey in the Singapore forest. So, if you see a mousedeer in our forest reserves, look closely for the features, write a complete description on the spot, and get a record photograph if you possibly can.

NATURE SOCIETY
(SINGAPORE)

A female Baya Weaver (*Ploceus philippinus*) bringing food to the nest.
Photo: Con Foley

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Baya Weavers

What are the males up to?

Text and photos by **Con Foley**

At a Baya Weaver colony in western Singapore, Con Foley makes some careful observations of behaviour and records it all in superb photography.

The Baya Weaver (*Ploceus philippinus*) has a wide geographical range, from Pakistan through South and South-east Asia to Sumatra, Java and Bali (but not including the Philippines as their Latin name would seem to suggest). The ecology of these weavers is generally fairly well understood. In Singapore, they occur wherever suitable grassland habitat is available as they need the tall *lalang* grass to build their nests. Although this area of suitable habitat is shrinking as more land is developed, there still appears to be a stable population. Lim (2009) lists Baya Weaver as a common resident with the local favorite nesting trees as Coconut (80% of all nests observed), as well as Acacia, African Tulip, Bamboo, Papaya and Tapioca. The breeding season is March to August.

My original interest was to photograph the female Baya Weaver flying into the nest to deliver food and to capture images of the beauty and grace of the bird in this behaviour. In a previous issue of *Nature Watch*, Volume 9/4 in 2001, Graeme Guy has already provided an excellent account of the general ecology of these birds. Like me, Graeme is a Past President of the Nature Photographic Society (Singapore) and his photography is first class. However, with the technique available at the time it was just not possible to capture small birds in flight using available light.

So, armed with a 300mm f/2.8 telephoto lens I selected a small nesting colony of weavers on an African Tulip tree (*Spathodea campanulata*) near Lim Chu Kang in early May 2008. I made a 20-meter length of wired cable release, which allowed the camera to be positioned next to the nest, but with me far enough back so as not to stress the birds. They were completely oblivious to the camera and behaved normally at this distance. All images were taken with natural light.

Facing page: Male on half-way completed nest. Only new flexible grasses are used for the weaving.

The colony consisted of 8 active nests and 5 incomplete 'helmet-stage' nests. For photographic purposes I paid most attention to two active nests with good backgrounds, one of which had an open background ('blue sky'), the other a leafy background ('green'). Ten trips were made to the colony from 9 May to 2 June. Initially the observations were as I had expected; the two females delivered food to their nestlings at regular intervals. The nestlings seemed rather mature, as they were heard calling when the female entered the nest. Then on 12 May I noticed a male entering the 'blue sky' nest, without food, and then quickly leaving again. The following day, the presumed same male entered the same nest a couple of times, again without food.

Consequently I switched my attention from the female to photographing the male. On 15 May the male was seen entering the 'blue sky' nest with food and this nest was then photographed exclusively through to 21 May. During this period the male continued to take turns with the female delivering food to the nest. The feeding interval varied but increased to about six times per hour towards the later days, with the male actually a bit more active, delivering about 4 times out of the 6 per hour. When I returned on May 22, the young had already fledged.

From 22 May onwards I photographed a male entering the 'green' nest. Similar observations of males bringing in food were made of the other active nests in the colony, but photographs did not document these.

After 23 May a period of dark, rainy weather occurred. On the next visit on June 2 all the remaining active nests had been abandoned, the young presumably fledged. All the abandoned nests were lying under the tree, and male birds had started construction of several fresh helmets.

The male brings food to the nest.

I then enthusiastically read all the available information on the Baya Weaver on the Internet and in the reference books available to me. Popular Internet sites such as Wikipedia, and all other Internet sites that I was able to find, state that males are polygamous. After he mates with the first female, he will try to mate with one or two more. Subsequently, only the female attends to incubation and to the nestlings. Wells (2007) writes the same.

I was able to find references by Suhel Quader that, in South Asia, male Baya Weavers occasionally do bring food to the nest. Guy (2001) mentioned this briefly as well but without providing documentation. So my photographs from Singapore appear to be the first such confirmation from South-east Asia.

Another observation of interest was the difference in the actions of males and females exiting the nest. Females literally just shot out of the nest at an unpredictable time, making photography difficult. Males, however, clung onto the nest entrance upside down and looked around for a few seconds before letting go and flying off. In my opinion, the male behaviour seemed

Females literally just shot out of the nest at an unpredictable time, making photography difficult. Males, however, clung onto the nest entrance upside down and looked around for a few seconds before letting go and flying off.

to be an extension of the male advertising antics, where he hangs onto the helmet and advertises for a mate.

Because the male appeared to make inspection tours of the nests to gauge development before joining the feeding activity, I also suspect that males bring food to the nest only in the last few days prior to fledging, when the nestlings' demands would be at a maximum and perhaps more than the female could undertake alone. Of course, this theory would have to be tested at more colonies in other locations.

Also, a closer check should be made of whether the males that exhibit this behaviour are monogamous or polygamous.

It is hoped that others will follow up and advance these observations. More of my pictures are available from this link: http://www.pbase.com/con_foley/weaver_baya. Just remember, please, that if you are going to take pictures of nests, keep a long way back from them to ensure the well-being of the birds.

Con Foley Cheong *is an active nature photographer and bird enthusiast. A long-time resident of Singapore, he supports the NSS Bird Group during censuses and bird races, and is also the Past President of Nature Photographic Society (Singapore).*

REFERENCES

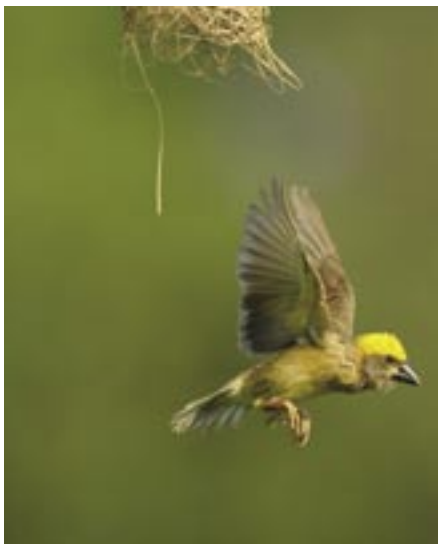
Guy, G. (2001) A Builder You Can Trust – The Remarkable Baya Weaver *Nature Watch* 9/4: 8-11.

Lim, K. S. (2009) *The Avifauna of Singapore*. NSS, Singapore.

Lim, K.C. & Lim K.S. (2009) *State of Singapore's Wild Birds and Bird Habitats*. NSS, Singapore.

Quader, Suhel: http://www.ncbs.res.in/suhel/index.html [30 Aug 2009]

Wells, D. R. (2007) *The Birds of the Thai-Malay Peninsula*. Vol. 2, Passerines. Christopher Helm, London.



The male checking out the scene (top) before leaving the nest (above).

A female brings food to the nest.

Rich growth of seagrasses.

Cyrene Reefs

Although squeezed from all sides by marine industry, the Cyrene Reefs are teeming with biological diversity. Ria Tan shows us around the site.

Text and photos by **Ria Tan**

Put on your life vest and don't fall off!" I yell. The little dinghy bobs up and down as a container ship the size of a fallen skyscraper slides silently by. A pink dawn glimmers through the city skyline, the enormous cranes of the container terminal reach out behind us. We cling on for dear life as the dinghy heads for a faint line of reefs. On the still dark horizon, the lights of petrochemical plants glitter. Then we arrive and clamber clumsily out onto Cyrene Reef.

These submerged reefs are only exposed at the lowest spring tides, giving us a short working window, usually at sunrise or near sunset. Together with an intrepid group of volunteers and scientists, I've been making these amphibious trips since 2007. So far, we've only visited Terumbu Pandan (which we simply call Cyrene), the largest of the three submerged reefs that are collectively called Cyrene Reefs. The other two are the much smaller: Pandan Beacon and South Cyrene Beacon.

Cyrene Reef is surrounded on three sides by Pasir Panjang Container Terminal, Jurong Island and Pulau Bukom. Although lying so close to these world-class industrial facilities, the marine life on Cyrene is astonishing.

Chek Jawa of the south

The reef has lush and vast meadows of seven seagrass species. The only other shores in Singapore with as many species are Chek Jawa and Pulau Semakau. Cyrene also has the rare *Syringodium isoetifolium*, called Noodle seagrass because it resembles stiff green 'mee hoon'. The only other place where Noodle seagrass grows in abundance is at Pulau Semakau. Indeed, Cyrene probably has among the last few large seagrass mead-

ows on our Southern shores. Certainly, they are the closest to the mainland.

Cyrene is especially rich in echinoderms; a group that includes sea stars, sea cucumbers, sea urchins, sand dollars and feather stars. Particularly abundant are the large cartoon-like Knobbly sea stars (*Protoreaster nodosus*). Cyrene is probably the only reef in Singapore where juvenile Knobblies are commonly seen. In fact, this location may be home to the only sustainable population of Knobblies!

Another spectacular sea star found at Cyrene Reef is the amazing *Pentaceraster mammilatus*, a new record for Singapore! It was previously known only from the western Indian Ocean and the Red Sea.

Cyrene also has fabulous living corals. Hsu et al. (1991) found Cyrene Reefs to have "the highest diversity of hard corals, with 28 genera covering 48.06% of the transect." Enormous leathery soft corals the size of a dining table, large boulders of hard corals and a wide variety of all kinds in between, are home to an array of fishes and other marine life.

Cyrene's broad sandy shores are also alive. Large stretches are thick with common sea stars and sand dollars.

Cyrene Reef also has some kinds of marine life that are common in Chek Jawa but less frequently encountered in the South, such as Haddon's carpet anemones (*Stichodactyla haddoni*), peacock anemones (Order Ceriantharia), Olive snails (Family Olividae), various sea hares. We have also seen a wide variety of sea stars, sea urchins and sea cucumbers on Cyrene, which we seldom see in the South but often encounter on our Northern shores.

A reef that's in the way?

Cyrene Reefs is at a key maritime crossroads where east-west traffic routes cross north-south traffic routes. 500 ships in excess of 5,000 DWT per day transit the waters around the reefs. To prevent collisions, a ring of beacons has been set up around the Reefs. The last major collision was by a ferry in December 2008.

The reefs lie just across from the enormous $2 billion Pasir Panjang Container Terminal project. Massive construction includes extensive reclamation to build 16 berths along a total quay length of six km that will increase our port capacity by 50%. Work began in October 2007 and is expected to be completed by 2013. While $20 million has been spent engaging experts to conduct studies on how these works may affect corals around Labrador, there has been no publicity on whether the review includes impact on other natural shores nearby such as Cyrene Reefs and those on Sentosa.

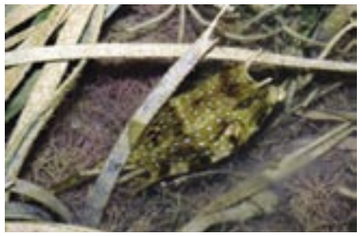
Does it make sense to conserve Cyrene?

The presence of such rich biodiversity on Cyrene clearly shows that Singapore has done something right when developing the world class port and petrochemical facilities that surround the

Cyrene Reefs is at a key maritime crossroads where east-west traffic routes cross north-south traffic routes. 500 ships in excess of 5,000 DWT per day transit the waters around the reefs. To prevent collisions, a ring of beacons has been set up around the Reefs. The last major collision was by a ferry in December 2008.

Reefs. It shows that Singapore CAN develop without wiping out every last vestige of natural habitat.

These credentials will stand us in good stead when Singapore participates in tenders to build or operate similar facilities elsewhere. In other countries, their reefs may be important for tourism, fishing or cultural heritage. Recent articles show that reefs, seagrass meadows and other coastal habitats have a vital role in carbon capture and climate change mitigation. As Singapore starts to 'export' our development approaches, being able to prove that our methods are sustainable will put us ahead of the pack. Indeed, the Port of Singapore Authority (PSA) already has many international operations. Currently, PSA International has investments in 28 port


Longhorn Cowfish (*Lactoria cornuta*)


Knobbly sea star (*Protoreaster nodosus*)


Cushion stars (*Culcita novaeguineae*)


Common Peacock Anemone


***Melibe viridis*, a bizarre nudibranch**


Soft corals

Can I put map inside box story?
Also, I excluded Vivo Ciy/Sentosa because it would make the Cyrene Reefs too tiny on a different scale.

Studying and informing about Cyrene Reefs

TEAMSEAGRASS volunteers have been monitoring Cyrene's seagrass meadows since 2006. The team also monitors seagrasses at Chek Jawa, Pulau Semakau, Sentosa, Labrador and Tuas. These activities are part of Seagrass-Watch, a global seagrass assessment and monitoring programme spanning 18 countries with more than 200 monitoring sites worldwide. The effort involves National Parks Board (NParks), Seagrass-Watch HQ and TeamSeagrass volunteers who now include about 60 regulars. (http://teamseagrass.blogspot.com)

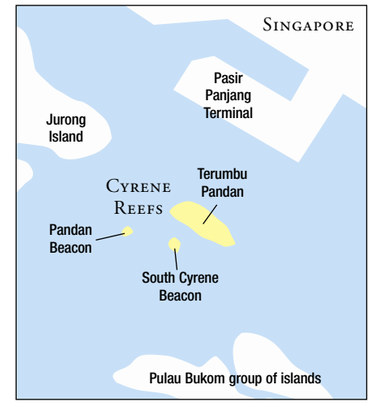
Star Tracker volunteers regularly visit Cyrene as part of their effort to monitor Knobbly Sea Star (*Protoreaster nodosus*) individuals in Singapore. Individual Knobblies can be distinguished by the unique number and arrangement of knobs, like our fingerprints. Thus the team is able to monitor growth, distribution and other details. The Star Trackers offered members of the public the opportunity to name these unique sea stars of Cyrene and 121 were named during the International Year of the Reef 2008 Singapore celebrations (http://startrackers.blogspot.com).

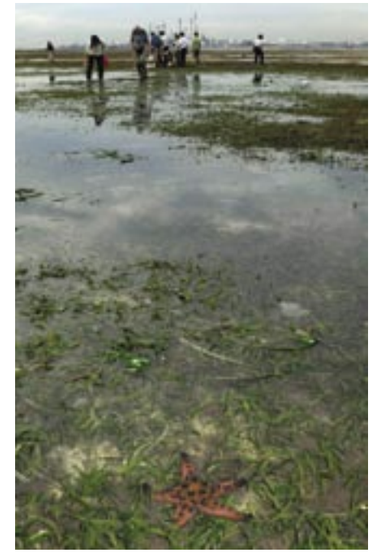
Naked Hermit Crabs volunteers set up the "I want to go Cyrene Reef" Facebook group and managed a blogging competition to allow winning members of the public to join their working visits and see Cyrene for themselves. Among the groups who visited were staff of the Urban Renewal Authority and members of the Nature Society (Singapore) (NSS). Experienced shore explorers among the Naked Hermit Crabs helped discover interesting species such as the *Pentaceraster*, for follow up by the experts. (http://nakedhermitcrabs.blogspot.com)

Cyrene is also a key site for marine studies in Singapore. Collin Tong of the National Parks Board (NParks) has just started a study to tag and monitor the large pipefishes found in the seagrass meadows of Cyrene, part of his work on this family of fishes in Singapore. Eminent scientists who visited Cyrene include Dr David Lane, leading echinoderm expert, who identified *Pentaceraster mammilatus* as a new record for Singapore. Dr Daphne Fautin, world authority on sea anemones also visited Cyrene in 2009 in her survey of Singapore sea anemones with the Raffles Museum of Biodiversity Research (RMBR). Dr. D. Kumaran Raju, GIS expert, graciously volunteered his time and knowledge to map Cyrene (Terumbu Pandan) As usual, he freely provided this information online for public use (http://www.wildsingapore.com/gismaps). Professor Teh Tiong Sa, our leading geomorphologist, has also visited Cyrene and shared his insights. Dr James Reimer, zoanthid expert also visited Cyrene in 2008 with RMBR.

Cyrene was featured in public exhibitions at the RMBR, the International Year of the Reef 2008 launch in August 2008, at RE-Live@Atrium in July 2008, and at Envirofest 2008 by the Naked Hermit Crabs in June 2008.

Cyrene has been featured in four articles in the Straits Times, one article in My Paper and a documentary on Channel U.





Cyrene is especially rich in echinoderms; a group that includes sea stars, sea cucumbers, sea urchins, sand dollars and feather stars.

Below: Spot the animal! There is an Alligator pipefish (*Syngnathoides biaculeatus*) in this picture.

projects in 16 countries across Asia, Europe and the Americas.

Being among the large and possibly best submerged reefs in Singapore, Cyrene can also contribute to the Singapore City Biodiversity Index. The index was first raised by Minister for National Development Mah Bow Tan at the 9th international Conference of the Parties to the Convention on Biological Diversity. Minister Mah said: "Currently, there are no well-established indices to measure biodiversity in cities. Such a City Biodiversity Index can assist cities in the benchmarking of our biodiversity conservation efforts over time. It can help us to evaluate our progress in reducing the rate of biodiversity loss."

Minister Mah noted that Singapore has managed to not only set aside 10% of land for parks and nature reserves — it has even increased the green cover to 50%. This is a 10% increase over the past 20 years, despite a 70% growth in population, he said.

Perhaps it is time to extend the City Biodiversity Index to the marine realm? We still have stunning marine biodiversity, despite the extensive development of our coasts and offshore islands. Cyrene is one testament to this.

World-class facilities near Cyrene Reefs

SINGAPORE is the busiest port in the world in terms of shipping tonnage, with about 140,000 vessel calls per year. At any one time, there are about 1,000 vessels in Singapore port. Every minute about 2 to 3 ships arrive or leave Singapore. Pasir Panjang Container Terminal is the largest of Singapore's four terminals. Together, the terminals handle about one-fifth of the world's total container transshipment.

Singapore has more than 80 shipbuilding and ship repair companies, holding about 70% of the world's market in jack-up rig-building and over 65% in the conversion of floating production, storage and offloading vessels. Most of the facilities are found along our Southern and South-western coastline.

Singapore is the world's third-largest petrochemical refiner. Jurong Island has 95 petrochemical companies located with more than S$31 billion in fixed assets. Within weeks of declaring the reclamation of Jurong Island completed in September 2009, there were reports that further reclamation is being considered, as land has run out on the Island. Bukom Island is the site of Singapore's first oil refinery and is the largest Shell refinery in the world.

Singapore is also one of the top bunkering (ship refueling) ports in the world. Annually, about 30 million tonnes of bunker oil are lifted in Singapore. This is enough to fill 12 million Olympic-size pools.

Singapore is a regional cruise centre with about one million visitors passing through the international cruise terminal (located next to Vivo City opposite Sentosa) from more than 30 international cruise ships making about 400 port calls per year.

Ria Tan *is well known in the NSS and the wider Singapore nature community for her activities and her digital presence and printed publications. She first fell in love with Singapore's shores working on Chek Jawa before planned reclamation there was deferred. Since then, she has gone on to explore, document and raise awareness about all of Singapore's other shores. She currently spends most of her time on field trips to the shores and running her website www.wildsingapore.com.*

REFERENCES

Hsu, L.H.L. & Chou, L.M. (1991) *Assessment of reef resources at sites identified for artificial reef establishment in Singapore*. An abstract is available on the Food and Agriculture Organization website at http://www.fao.org/docrep/w7387e/W7387E08.htm.

MEDIA ARTICLES ON CYRENE REEF

Chua, G. (2009) Blue Plan to save Singapore's biodiversity-rich coral reefs ready. Conservationists urge Government to step in to save what's left. *The Straits Times*, 24 Apr 2009.

Kesava, S. (2008) Ordinary Singaporeans lead the green charge. *The Straits Times*, 16 Aug 2008.

Lane, D.J.W., Ngian, R. & Tan, I. (2008) A new star for Singapore. Discovery of large five-rayed sea star adds to marine biodiversity here. *The Straits Times*, 3 May 2008.

Lee, B. (2007) Singapore to spend $2b on port expansion. When completed by 2013, it will increase annual capacity by over 50 per cent. *The Straits Times*, 21 Dec 2007.

May, K.S. (2008) We all have a name and IC! Sea stars of Cyrene Reef in the news. *My Paper*, 11 Aug 2008.

Tang, L. (2008) Singapore's neglected heritage. *The Straits Times*, 23 Jun 2008.

Galapagos

Can Darwin's Lab Survive Success?

Text and photos by **Bjorn Olesen**

Bjorn Olesen visits the Galapagos Islands, the birthplace of eco-tourism, and he reflects on some of the lessons learnt.

Originally known as the Enchanted Isles, Galapagos is located some 1,000 km off Ecuador's coast and consist of 13 main islands plus 115 small islets, all of volcanic origin. The total land area is 7,900 square km, about 10 times the size of Singapore.

This archipelago is universally viewed as one of the most unusual and precious ecosystems on earth. It was first recognized in 1835, when Charles Darwin stopped there on the HMS Beagle as a part of a 5-year expedition. Half the birds, more than half of the insects, a third of the plants and all the reptiles are endemic to Galapagos, being found nowhere else on the planet.

Prior to 1800, pirates had established small outposts on the islands. The pirates were later replaced by whalers. Galapagos was claimed by Ecuador in 1832, after which small permanent settlements were established. At the time of Darwin's visit there were some 200-300 people living there.

Eco-tourism started here

Coming forward in time, the Galapagos is often cited as the place where eco-tourism started. Since the late 1980s the islands have had to cope with a variety of complex problems that have all come in the wake of the ecotourism boom: New immigrants, introduced species, industrial over-fishing, and conflicts between development interests and park management.

Despite the passage in 1998 of The Special Law for the Galapagos by the Ecuadorian Government, the number of people living in the Galapagos has increased from 20,000 in 1998 to 40,000 in 2006 (including illegal immigrants). Tourist arrivals have more than doubled over the last ten years as well, with serious implications.

Under the Special Law, tour companies are required to hire locally, unless they can prove that the skills they require are not available on the islands. When stopping at islands with human settlements, many tour companies now arrange for passengers to visit restaurants, private farms, and local schools. By 2006, there were 114 restaurants/bars in the Galapagos, up from just 20 in 1982. Larger vessels are required to visit two parts of the islands during an eight-day tour, and this has stimulated new ecot-ourism income for the communities.

New immigrants reinforce a frontier mentality bringing a culture based on resource extraction, low awareness about the Galapagos ecosystem, and strong external alliances. Commercial fishing, while legally restricted to fewer than 1,000 local fishermen, continues to grow, with serious environmental consequences.

Pinnacle Rock, Bartolome Island.

Space is very tight overall, so for caption I only give one line.

The Great Frigatebird (*Fregata minor*).

The endemic Galapagos Sea Lion (*Zalophus wollebaeki*).

The Marine Iguana (*Amblyrhynchus cristatus*).

The Galapagos Land Iguana (*Conolophus subcristatus*).

The endemic Galápagos Giant Tortoise (*Geochelone nigra*).

One of the most worrisome environmental threats to the Galapagos Island has been the introduction of non-native species - accelerating in the wake of the eco-tourism and immigration booms.

Goats, for example, were introduced way back in the 1850s and immediately began to take food away from indigenous tortoises and iguanas. On the island of Isabella, there are more than 200,000 goats, which are extremely adaptable and hard to exterminate.

There are many other introduced pests: cats kill young iguanas and chicks of birds; dogs eat turtle eggs and hunt adult iguanas. Pigs destroy bird nests; donkeys devour vegetation; rats eat eggs of the giant tortoises. Invasive species also include insects and plants, which are equally threatening.

But eliminating one species at a time is not practical. The vegetation that goats eat provides cover for feral pigs. Cats eat rats. Dogs kill cats. There needs to be an integrated, well-designed programme. Eradicating introduced species and keeping new ones from arriving is a never-ending and enormously costly struggle.

By 2007, scientists have indentified introductions of 36 species of vertebrates (including donkeys, cattle, goats, dogs), 540 species of invertebrates (various ants, wasps, flies), and 740 plant species, and the numbers continue to rise.

In 2001, UNESCO granted World Heritage status to this gigantic marine reserve which covers 138,000 square km. But despite these positive steps at setting a legal framework for protection, the Galapagos remains at risk. In June 2007, UNESCO added the Galapagos to the list of "World Heritage in Danger" sites, noting specifically the negative effects brought by the sizeable growth of tourism, which had grown from 41,000 visitors in 1990 to around 145,000 in 2006.

Eco-tourism Scorecard

Some have heralded the Galapagos Islands, with their geographic remoteness, well-run national park and biological research station, low-impact floating hotels, and environmentally aware tourists, as a model of sustainable and sound eco-tourism.

But the islands remain at a crossroads, and this is an appropriate time to evaluate how they stand up on the seven characteristics of effective eco-tourism as defined by Honey (1999):

1. Involves Travel to Natural Destinations

Nature is the allure of the Galapagos. This mid-ocean moonscape of stark lava rock and scrub brush remains one of the world's most precious ecosystems. It offers eco-travellers both unique clues to understanding evolution and chances for close encounters with exotic creatures.

2. Minimizes Impact

During the past decades, tour operators, naturalist guides, national park officials, and research station scientists in the Galapagos have worked together to create a model for low-impact, high-quality eco-tourism (*See box story*). However, the 2007 decision to include the Galapagos on the list of endangered World Heritage sites indicates strongly that tourism numbers have become too high for the islands' capacity.

More serious are three other problems that only partially are connected with the ecotourism boom: introduced species, immigration, and commercial fishing. In particular the enforcement of the immigration section of The Special Law has been very patchy.

So on this dimension the record has been very mixed.

3. Builds Environmental Awareness

Eco-tourism has helped to expand the world's understanding of the islands' uniqueness and fragility. The many visitors have helped to spread the word, and so has the countless nature documentation and infotainment programmes produced there and shown in Ecuador and all over the world. Although, as visitor numbers have grown exponentially, there has been a gradual watering down of environmental emphasis. Overall, the record in this respect has been good.

4. Provides Direct Financial Benefits for Conservation

The Galapagos Islands are Ecuador's biggest tourism destination, bringing in one-third of the government's revenue from tourism. The increased entrance fees for foreigners, and the increase in the percentage of gate fees kept by the national parks service have greatly increased the amount of funds for environmental protection. This is a solid victory for conservation, but it comes at a time when the islands and marine reserve are facing greater environmental assaults then ever before.

5. Provides Financial Benefits and Empowerment for Local People

Eco-tourism has done both. Since the late 1980s, the standard of living and job opportunities on the islands have grown, as has the political militancy of the local population. The Special Law dictates a fairly even distribution of park entrance fee revenues. Moreover, it outlines measures to strengthen economic capacity and opportunities, educational level, technical skills, and social services of the resident community, while attempting to curb its unsustainable level of growth. This is a clear victory for the islanders. However, trends in recent years show a stagnation in benefits for local people, as the "quality" and average spending of each foreign tourist declines.

6. Respects Local Culture

This is not a significant issue in the Galapagos, since most of the local community is recently imported.

7. Supports Human Rights and Democratic Movements

Over the last decade or more, a representative movement has developed that pushed for participatory democracy on the islands and for the passage of the Special Law by the national government in Quito, the capital. This highly significant development is in line with the principles and goals of eco-tourism, so a positive development.

In the Galapagos, more than almost anywhere else in the world, the only viable commercial activity is high-quality, limited, and carefully monitored eco-tourism. This, combined with the key components of the 1998 Special Law, which aims to carefully regulate immigration and fishing, holds out a possibility of protecting the fragile environment and striking equilibrium with the local population. If enforcement of the local regulations could be improved, and a meaningful increase in the entrance fees for foreigners implemented, and if numbers were well controlled and/or reduced, then the outlook for the archipelago would look bright.

The Millennium Tourboat.

Waved Albatross (*Phoebastria irrorata*).

I agree with Tom Fritts, a wildlife biologist with the Smithsonian Institution's National Museum of Natural History, who states in Honey (1999): "The bottom line is that ... the Galapagos still have about 95% of their native species of flora and fauna ... They are disturbed but not destroyed." So, for those who have the opportunity, I strongly recommend a visit to the Enchanted Isles, where you can still find those untouched places of nature that is pure magic.

***Bjorn Lynggaard Olesen** is a member of NSS and life member of MNS. He is a freelance wildlife photographer, long-term resident in South-east Asia and permanent resident in Singapore. He supplies his images to publications and websites in the region.*

Commendable Ecuadorian Ecotourism Initiatives

A) The **Ecuadorian Ecotourism Association** (ASEC) founded in 1991 was one of the first national eco-tourism organizations in the world. In early 2008 ASEC had 67 members (7 in Galapagos) representing all the social sectors of eco-tourism in Ecuador: Indigenous and local communities, private tour operators, NGOs, universities, local governments, the Ministry of Tourism, clean energy companies, and private individuals. Together these members manage approximately 76% of incoming tourism in Ecuador.

B) The larger tour operators founded a dynamic, non-profit organization in 1995, **International Galapagos Tour Operators Association** (IGTOA) to lobby the Ecuadorian Congress for passage of the Special Law. Their stated mission is to: "preserve the Galapagos Islands as a unique and priceless world heritage that will provide enjoyment, education, adventure, and inspiration to present and future generations of travellers." IGTOA has become the collective voice to petition the government of Ecuador for proper funding, management and legal enforcement.

C) **The Galapagos Chamber of Tourism** (CAPTURGAL), founded in 1996, spearheaded in 2005 a green certification programme for local products in tourism, fishing and agriculture sectors.

D) In 2001, **Smart Voyager**, a new environmental certification programme for boats in the Galapagos was launched in a collaboration between Conservación y Desarrollo, an NGO citizen's group founded in 1992 and based in Quito, and the Rainforest Alliance, an American environmental NGO. By 2007, Smart Voyager had certified 8 boats and also moved into certification of hotels throughout Ecuador.

E) For renewal of operating licences, local authorities require all boat operators to subscribe to **oil and solid waste recycling programmes**, and to obtain a fumigation certificate to prevent introduction of alien species. Boats must also be fitted with holding tanks for wastewater, which is then collected in ports by local councils. In 1999, a used-oil recycling programme was started which has recycled 120,000 gallons of oil up to 2005 - equivalent to 75 percent of the total oil used in the islands.

REFERENCES

Andrew, D. (2006). *Watching Wildlife: Galapagos Islands Guide*. Lonely Planet.

Boyce, B. (2004). *A Traveller's Guide to the Galapagos Islands*.

Honey, M. (1999). *Ecotourism and Sustainable Development: Who Owns Paradise?* Island Press, Washington, D.C.

Stronza, A. & Durham, W. H. (eds.). (2008). *Ecotourism and Conservation in the Americas*. Oxford University Press.

A Galapagos Reading List: http://people.rit.edu/rhrsbi/GalapagosPages/Bibliography.html

Challenges Facing Galapagos: http://www.igtoa.org/info_for_travelers/issues_facing_galapagos.php

Galapagos Conservancy: http://www.galapagos.org/2008/index.php?id=49

Galapagos News: http://www.igtoa.org/news/