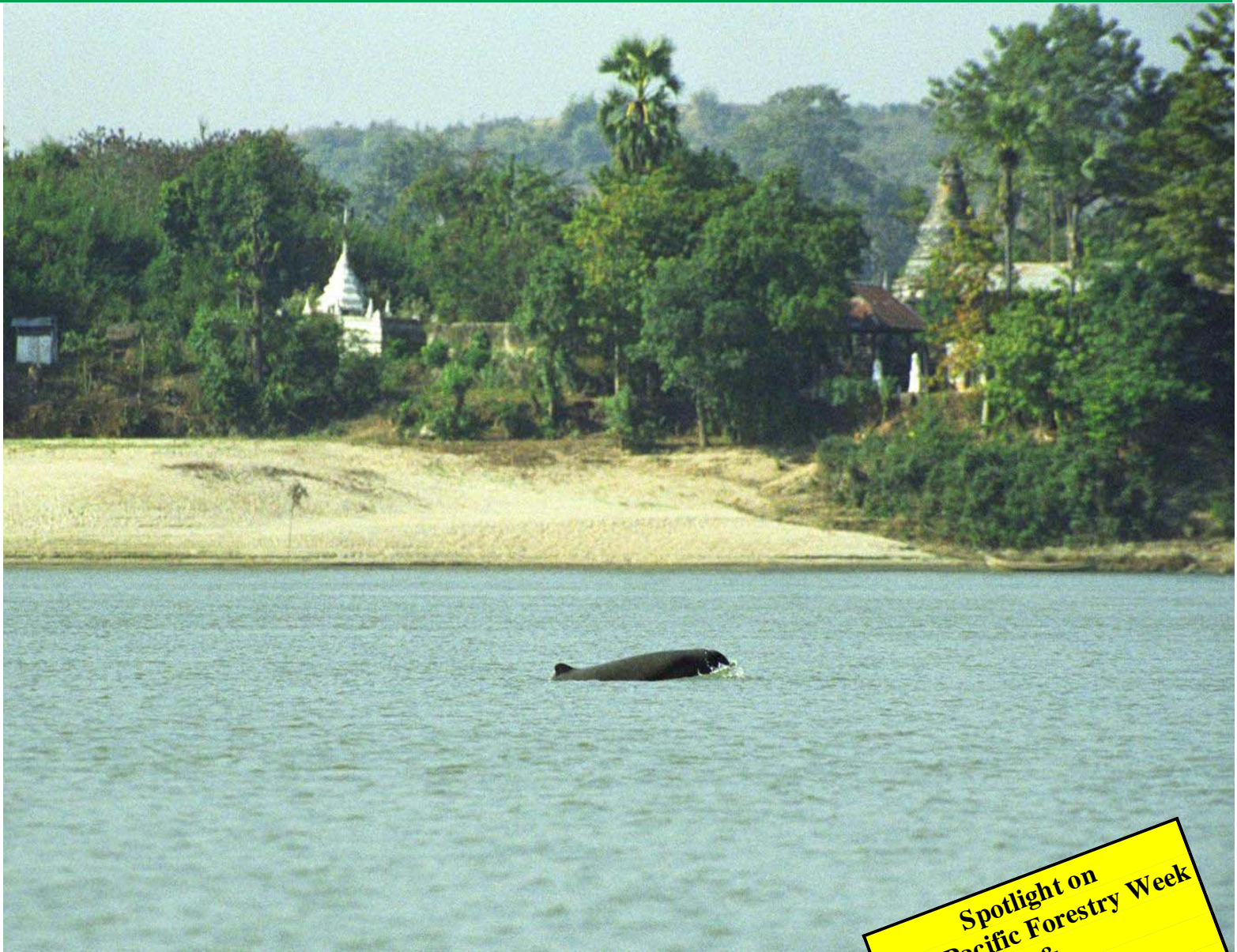




TIGER PAPER

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Featuring

**Spotlight on
Asia-Pacific Forestry Week
&
APFC 22**

FOREST NEWS

Contents

TIGERPAPER

Mutualistic Fishing Between Fishermen and Irrawaddy	
Dolphins in Myanmar.....	1
Wetlands and Climate Change.....	9
Amphibian Faunal Diversity of Beraliya Mukulana Proposed	
Forest Reserve.....	12
Dry Matter and Organic Value of Cuscus Diet in West	
Papua.....	17
Community-based Eco-tourism: Case study of Taman Safari	
Indonesia.....	21
Re-sighting of Indian or Greater False Vampire in Gujarat.....	28

FOREST NEWS

Asia-Pacific Forestry Community Gathers for Landmark	
Event in Hanoi.....	1
Benefits from Forestry Week Inputs.....	6
Parallel events:	
Protected areas, equity and livelihoods.....	9
Potential of bamboo in the Clean Development Mechanism...	11
Disseminating scientific information for policy and	
management.....	12
Money does grow on trees!.....	14
Asia-Pacific universities forest education network.....	15
National forest programmes in Asia and the Pacific.....	16
Global Forest Resources Assessment (FRA 2010).....	17
Teaknet.....	18
Asia-Pacific Forestry Outlook Study: making progress.....	19
FAO Asia-Pacific Forestry Calendar.....	20



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Cover: Irrawaddy dolphin (*Orcaella brevirostris*) off the coast of Myanmar

Photo: Shingo Onishi

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Fisherman casting the net (Photo: Shingo Onishi)

MUTUALISTIC FISHING BETWEEN FISHERMEN AND IRRAWADDY DOLPHINS IN MYANMAR

by Shingo Onishi

Irrawaddy dolphin

There is a dolphin species whose name derives from the Ayeyarwady (Irrawaddy) River of Myanmar, namely the Irrawaddy (Ayeyarwady) dolphin (*Orcaella brevirostris*). This dolphin is generally known to be distributed throughout the coastal areas between Southeast Asia and northern Australia.

I saw dolphins similar in shape and size to Irrawaddy dolphins at the muddy coast of Kawthoung, at the southernmost tip of Myanmar, but could not identify the species. I also heard the breathing sounds of dolphins at night in the delta mangrove area nearby the mouth of the

Ayeyarwady River. Local foresters said that the sound was made by Irrawaddy dolphins and that there was a large population in that area.

The Ayeyarwady River is the largest habitat of Irrawaddy dolphin in Myanmar. The main body of the river flows from north to south through the central part of the country. Several separate populations of dolphins are found along the river.

Apart from the delta area, other populations inhabit the middle reaches of the river, from over 900 km up to about 1,400 km from the mouth of the river, stretching from slightly north of Mandalay to around Bhamo. The altitude ranges from 70-110 m.

In 2004, using the direct count method, the Department of Fishery, Ministry of Livestock & Fisheries, Myanmar and the Wildlife Conservation Society (WCS) estimated the number of Irrawaddy dolphins between Mandalay and Bhamo to total 72 from 13 different locations. The northern part of the area between Kathar and Bhamo is the larger habitat. In addition, there could be about 18 to 20 dolphins in the southern part, i.e., Mingun and Kyaukmyaung (Aung Myo Chit, Coordinator, Irrawaddy Dolphin project, WCS, 2008).

It is said that some dolphins in this southern habitat have a close and unique relationship with the local fishermen. In order to document this relationship I visited several villages between Mingun and Kyaukmyaung and stayed with the fishermen from 27 August to 1 September '07 during the rainy season, and from 7 to 13 January '08 in the dry season.

Village life

Many villages are permanently settled on sandbanks of the Ayeyarwadyi River around there. Villagers depend on the river water for bathing, washing and cooking and their life cycle depends on the water level of the river. The land area becomes smaller in the rainy season and larger in the dry season. Some sandbanks can be connected with the mainland in the dry season.

Most of villagers make their living farming or fishing or both. Farming can be done only in the dry season when the land area becomes larger. Cultivating usually starts in October. Cattle are used for plowing and cow dung is used as manure. Some people also raise chickens and pigs to supplement their income. The main crops are peanut, maize and various beans, and are usually harvested around March and April. Young people tend to be farmers because they can inherit farming implements and techniques from their parents.

On the other hand, there are many people who are involved in both farming and fishing. They feel that farming is risky and unstable because crops can be damaged by insect attacks, and therefore since fishing is their vocation and farming is a sideline, they can be regarded as fishermen. One fisherman said that he earns two-thirds of his total income from fishing and one-third from farming. There are

also a considerable number of full-time fishermen as well.

Fishing methods

The local fishermen mainly use three kinds of fishing gears:

a. longline

Many short strings are hung at regular intervals from a long string as a leader. A fishhook is fastened at the tip of each short string. Then, this longline is extended under the water and both ends are fixed on the riverbed.

b. gill net

A long, narrow net is attached along a long string. The net is held vertically tense by many lead weights under the water. The net is about one meter in depth and normally about 40 m in width, although some nets can reach about 80 m in width. There are two ways to use a gill net: fixing or floating. In the case of fixed nets, the spread net is fastened to bamboo poles which are firmly planted on the riverbed and left under the water there for a while. In the case of floating nets, the net is gradually paid out into the water from the boat and extended in the river. The end of the net is held by the fisherman on the boat, and the net drifts down the river together with the boat. After a short time, the fisherman hauls up the net. This process is repeated. In this case, the net is called a drift net. The drift net has many floats on the top line and has less lead weights than the fixed gill net.

c. casting net

The casting net is about 5.5 m in length, with a diameter of more than 10 m when completely spread out. The net is woven of nylon thread by the fisherman and his family. Weaving tools are made of bamboo. It takes about two months to weave one net. Some fishermen said that about 4 kg of thread are used to make one net. Many small lead weights of about 7 kg are fixed along the edge of the net. Thus, the total weight of the net would be more than 10 kilograms. This is why it can only be handled by adult fishermen. When a boy fisherman has reached his late teens, he starts to practice throwing the net. It needs patience and skill to get the knack of spreading the net circularly.

The gill net method is applied when the water

level is higher, from around March to September. The casting net is applied throughout the year. Some fishermen use all methods while others use only one method.

Fishermen usually use fishing boats, which are made of wood and normally about 4 m in length. As the boat doesn't have a screw, the fisherman rows it by wooden oars. When they go fishing, a pair of fishermen commonly rides on a boat. One person stays near the bow and another stays near the stern. To steer the boat at full speed, two persons row in unison. Then, when they are fishing, one person handles the fishing gear and while the other controls the boat. Women also row boats and join the fishing, but the casting net is usually thrown by men.

Mutualistic fishing

When the water level is higher in the rainy season, Irrawaddy dolphins don't approach the fishing boats closely, but neither do they nervously avoid them.

The fishermen said that the dolphins are afraid of gill nets and avoid approaching them throughout the year, but they are not afraid of casting nets. Moreover, some dolphins approach fishing boats and jointly go after fish when the water level is lower in the dry season. One fisherman said that the catch from casting net fishing with dolphins is ten times larger than it without the presence of the dolphins. He also said that he can only catch enough fish for his family's consumption when solo fishing, but can catch enough fish to sell by fishing with dolphins. The fishermen who are able to fish with dolphins are fixed, village by village. The members should be casting net masters and have the knowledge and technique of how to fish with dolphins. Of course, they can fish without the dolphins, but they always expect the dolphins to appear in the dry season.

It is generally said that the dolphin tends to be solitary or travel in small schools in the rainy season, while they tends to form large schools of up to dozens of heads in the dry season. But during my study, the dolphins acted solitarily or in small schools of up to 6 heads in both the rainy season and the dry season. The fishermen can identify

each individual dolphin and predict which dolphin will join them. They even give the dolphins names such as 'Aunty Nape', 'Aunty Side Stripe', 'Aunty Gecko', 'Reddish Guy', 'Yellow Girl', 'Cute Chubby Boy' and so on.

When the fishermen spot dolphins, they approach the dolphins at full speed. Then, the fore fisherman lightly taps a short stick made of wood or bamboo on the gunwale in a quick rhythm, while the rear fisherman mightily hits and splashes the surface of the water with the oar. They do this frequently while they are rowing the boat. According to them, these actions signal the message to the dolphins "Shall we go fishing together?" Actually, these actions can transmit particular sounds and vibrations to dolphins through the water. In addition, fishermen continuously mimic the dolphin's voice.

If the dolphins are familiar ones and they agree to do the fishing together, the dolphins lead the fishing boats. If dolphins swim at full speed, they can easily outdistance the boats and the boats would not be able to follow them. But the dolphins seem to adjust their speed to that of the boats. The dolphins search for a good fishing point and gradually approach it.

The joint activity depends not only on the individual dolphin, but the place also determines whether the dolphins will join the fishing or not. Even if dolphins meet well-known fishing boats, they may consider the conditions. Then, if they judge the conditions are not so good for fishing because the water is too deep or too fast or so on, they may not join the fishermen.

Good fishing points are normally in the shallows. When the dolphins reach the chosen point, they start swimming quickly right and left under the water. This gets fishes to move together. When dolphins start to act so, the fore fisherman stands up on the front upper deck and stretches the folded casting net and hangs it on his dominant arm. When the net is ready to throw, the fisherman knocks the net's weights on the upper deck. This is the final signal to dolphins messaging "We are ready to throw the net." While the fore fisherman is handling the net, the rear fisherman steers the boat.

When dolphins have finished herding the fishes into the small range between dolphins and the boat, a dolphin will suddenly flap the surface of the water with the caudal fin or will suddenly lift up the caudal fin and wave it in the air. This is the signal to fishermen to cast the net. As soon as the dolphin gives this signal, the fisherman throws the casting net. The tip of spread net would reach about to the spot of the fin signal.

Then, the fisherman slowly hauls up the net. While the net is being hauled in, the dolphins gradually approach the boat following the net. The fishermen

say that the dolphins eat the fish that escape from the net. Actually, the body of dolphin under the water cannot be seen because of the muddiness of the water. But their movements can be assumed by the bubbling or rippling of the water.

When the net is completely hauled up onto the boat, dolphins swim away. While the fisherman is unraveling the net and collecting the fish, other boats chase the dolphins to the next fishing point. One after another each boat fishes with the dolphins. The fishing fleets of some villages consist of 8 boats, while in other villages there may be only 2 boats.





The dolphin flays at the surface of the water with a caudal fin. This is the signal for the fisherman to throw the net. (Photo: Shingo Onishi)





The dolphin herds the fish towards the net. (Photo: Shingo Onishi)





Fisherman pulling in the net. (Photo: Shingo Onishi)

By this cooperative method, the fishermen can certainly get a larger catch and the dolphins can easily obtain fish for themselves, and thus both sides receive benefits. This relationship is just like mutualism in the biological point of view. So, I would like to call this fishing method “mutualistic fishing”. The peak period of mutualistic fishing is from October to February.

Concerning the number of dolphins, some fisherman said that about 10 head would join the fishing, while others said that only 5 or 6 head used to join. And some fisherman said that up to 20 head have sometimes joined.

During my stay, I witnessed three schools of dolphins joining the mutualistic fishing. Each time the number was 4 to 6 head in each school. According to the fishermen, each school consists of adult females and young dolphins, both male and female, and they should be related by blood.

I observed some young dolphins occasionally splashing on the surface of the water, and a junior fisherman prepared to throw the net. Suddenly, a veteran fisherman shouted “Don’t throw! It is just

playing.” Knowledge and techniques are definitely being passed on to the next generation of dolphins and fishermen. The oldest fisherman of one village, aged 58 years, said that his parents also used to do the casting net fishing with dolphins. He estimated that this fishing method has been done for more than 80 years, but less than 100 years.

I hypothesize that the beginning of the mutualistic fishing came about when one day some dolphins and some fishing boats were chasing the same target of fishes. The dolphins saw that many fishes were caught by the casting net, but some of them also escaped from meshes of the net and from the gap between the net and the riverbed. The dolphin realized that it would be easier to catch fish if it followed the edge of hauling net and subsequently approached the boats closer year by year. On the other hand, fishermen already appreciated how skillful dolphins were at searching for and gathering fishes. So, they began to work together. The rule is that dolphins lead boats to fishing points and gather fishes and fishermen catch fishes and never hurt or kill dolphins.

Issues

Dolphins seem to dislike all kinds of motorboats. According to my observation, even while the dolphins were accompanying the fishermen's boats, if some motorboat was getting closer to them, the dolphins stopped fishing for a while. When local boatmen of motorboats notice the mutualistic fishing operation, they change their course and try not to disturb the fishing. But captains of larger passenger boats and cargo boats seem not to care.

Mandalay, the second largest city of Myanmar, is about 10 km south of the southern limit of this dolphin habitat. As the city is the important point of waterborne transportation, the surface and the riverside of the Ayeyarwady River are congested with many boats. Many pleasure boats also sail up to the famous ancient city of Mingun, which is located near the southern limit of this dolphin habitat. All of the fishermen and captains said that dolphins never move downstream lower than Mingun.

Some illegal fishing methods reduce the fish population and also may directly hurt the dolphins. The most terrible fishing method is the so-called "shock fishing". The illegal fisherman uses a powerful battery or generator to send a high voltage electrical current into the water. Then, he collects the shocked fishes. Legitimate fishermen said that one dolphin was electrocuted by this illegal method in 2005. Now, the government is trying to control such illegal actions, but they are still continue secretly.

The reason why fishermen and dolphins can share fish catches is that there are enough fish in the river. Fish can energetically propagate as long as the river water is not too polluted and is filled with nutrition. The nutrition can be constantly supplied by the rich forest of the vast catchment area. If such a balance becomes upset, the fish population will decrease. Then, fishermen and dolphins will be rivals chasing a limited fish stock. Moreover,

the fishermen could begin to chase the dolphins themselves as prey. Some modernized fishing methods can be a factor in upsetting the balance around the river. It is risky to sharply decrease the fish population.

The government lists the Irrawaddy Dolphin in the completely protected animals list. The Department of Fishery, Ministry of Livestock & Fisheries, with WCS, has the system to issue identification cards to cooperative fishermen to request their participation for the conservation of the Irrawaddy dolphin and their joint fishing culture.

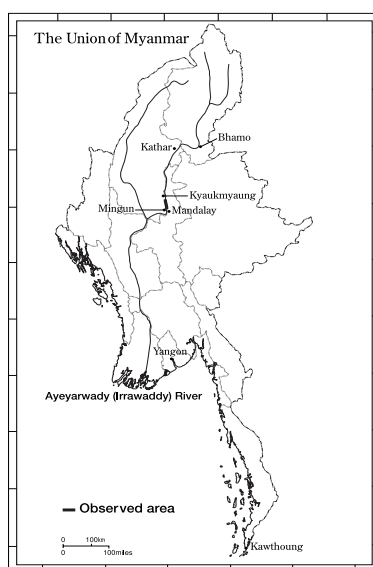
They cooperate in the patrolling, the research and spreading the education program. But some fishermen still won't agree to hold the license. They may not want to be restrained by anybody.

If someone wants to be rich, who can stop it? If someone wants to chose an easier way, who can stop it? We should not think that the traditional fisherman's lifestyle is inferior. Actually, as long as they keep to this fishing style, they can be satisfied with enough fish on a sustainable basis. We should commend the fishermen so that

they can proudly keep on with their own lifestyle.

What I can do now is to introduce this amazing relationship between animals and humans, and to let people notice how noble they are and how harmless to the earth their actions are.

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Haleji Lake, Thatta, Sindh, Pakistan

WETLANDS AND CLIMATE CHANGE

by Muhammad Rais

Earth came into existence and became part of this universe almost four billion years ago; however, it took ages for any life forms to evolve on this planet. The main hindrance was the harsh and unfavorable conditions, e.g., high temperatures, the accumulation of poisonous gases and lack of oxygen in the atmosphere, and ultraviolet radiation from the sun reaching the earth unchecked. Still, the major constraint to the origin, evolution and diversification of life was the unavailability of water. Water totally dominates the chemical composition of all organisms. The ratio of water and solid mass is roughly 70:29% in all organisms. Moreover, at the cellular level water constitutes the same percentage. Seventy-one percent of the earth's surface is covered with water. Most of earth's water is held in the oceans

(97.61%), some is frozen in polar glaciers (2.08%), and some is present as ground water (0.29%). Less than 1% is available in the form of fresh water lakes and rivers. (Kalinin, 1969). But how and where did the water come from? We now know that the earth was continuously burning and carbon dioxide and water vapors were given off as a result of combustion. These were believed to extinguish the fires and deep trenches on the earth's surface were filled with this water. In this manner, wetlands came into existence. Wetlands are those lands that are inundated with surface or ground water with a frequency sufficient to support plant and animal communities whose survival depends on saturated or seasonally saturated soil. The estimated global area covered with wetlands is 12.8 million km².

The very water and wetlands that created favorable conditions for life are now facing many threats, but the major one is “global warming”. The burning of fossil fuels, changes in land cover and land use, etc. have resulted in increases in global temperatures, which inevitably results in changes in the precipitation, the melting of polar ice caps, and rises in the sea level, all of which will have serious implications for the wetlands.

Impact of climate change on wetlands

Alterations in the climatic pattern will have far reaching, deleterious consequences on the health of wetlands and their dependent life forms. Climatic changes may bring about changes in hydrological regimes, in the pattern of evaporation, biogeochemical cycles, the cycling of nutrients and suspended particles.

Without wetlands, the coastal, inland and high altitude areas will all have to bear the consequences equally. As for lakes and streams, a climate change would result in the reduction of the polar ice cover, decreased availability of dissolved oxygen in deep water, and an increase in the frequency of extreme events, e.g., floods in some areas and drought in others.

Effects on wildlife associated with wetlands

Rises in the temperature increases the duration of hot days. In fact, some wetland-dependent wildlife, e.g., amphibians and reptiles, are sensitive to heat and would find it difficult to adjust to prolonged spells of heat. Some of them have already disappeared, which has disturbed the food chain and is affecting those placed higher in the food chain. Likewise, as parasites are unable to procreate in cold environmental conditions, fewer frost days could increase the incidence of diseases and epidemics to an unprecedented level.

Changes in the ice cover duration and ice thickness

Higher global temperatures would undoubtedly decrease the ice cover and ice thickness in the polar regions, and non-polar glacial retreat would be favored. Consequently, wildlife in the polar regions such as polar bears, arctic foxes, etc. will

be affected. Moreover, processes regulated by ice cover, for instance, gas exchange with the atmosphere, erosion, nutrient cycles, biodiversity and primary productivity, will be seriously affected.

Effects on fisheries

It is generally believed, and been proven by some studies, that some fish species respond to higher temperatures by showing rapid growth. Nonetheless, the negative implications of this are seldom taken into consideration, such as that rapid growth demands more food, places to live and the chance of diseases escalates.

Alteration in species abundance, diversity and composition

Wetland-dependent species that do not have excellent mobility will face extinction if environmental conditions change beyond their tolerable limits. Even those with greater mobility will also be affected; for example, cold water fishes would be restricted in their range while warm water fishes would expand their range.

Ecological succession

Climate change and higher temperatures favor the replacement of original wetland communities such as swamps and fen peat land communities with other types like bog peat land.

Salt water intrusion

Rises in the sea level may severely affect the low-lying wetlands. For instance, flood plains and swamps in low-lying regions could be displaced by saline habitat due to the cumulative effects of salt water intrusion, intense rainfall, storm surges, etc. Plant communities that cannot tolerate high salinity and inundation become replaced with mangroves and other salt-tolerant plants.

Altered bird migration pattern

Changes in the wetlands that could be used as staging, wintering and breeding sites for bird species that migrate continent to continent, and even those migrating within country, will put the birds at risk.

Conclusion

Climate change and global warming poses a great danger to the wetlands and their dependent wildlife. With each passing day the amount of green house gases being emitted is increasing, which contributes to the rise in the global mean temperature, which in turn causes other deleterious changes in the environment such as prolonged heat spells, fewer cold days, the melting of ice masses, rises in sea level, etc. Now is the time to take action to protect the wetlands and preserve their

values and functions. This could be achieved by developing a comprehensive structural framework at global and regional levels to minimize the emission of green house gases, by restoring peat lands and natural carbon sinks, and by launching a public awareness campaign before it is too late.

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Hingol National Park, Baluchistan, Pakistan

AMPHIBIAN FAUNAL DIVERSITY OF BERALIYA MUKALANA PROPOSED FOREST RESERVE

by D.M.S. Suranjan Karunaratna, U.T. Indika Abeywardena, A.A. Thasun Amarasingha, D.G.

Ramyath Sirimanna and M.D. Chandana Asela

Introduction

Sri Lanka is a biodiversity hotspot rich in herpetofaunal assemblages (Bossuyt *et al.*, 2004; Meegaskumbura *et al.*, 2002). Favorable environmental factors such as high rainfall and humidity and the high density of undergrowth found in this region support a rich diversity of herpetofauna. A total of 103 species of amphibians have been recorded (De Silva, 1996; Dutta & Manamendra-Arachchi, 1996; Manamendra-Arachchi & Pethiyagoda, 1998; Manamendra-Arachchi & Pethiyagoda, 2001a; Manamendra-Arachchi & Pethiyagoda, 2001b; Manamendra-Arachchi & Pethiyagoda, 2005; Meegaskumbura & Manamendra-Arachchi, 2005) and 87 species belonging to 16 genera are endemic to the island. Among those genera, *Lankanectes*, *Nannophrys*, and *Adenomus* have been considered as relic genera (Manamendra-Arachchi & Pethiyagoda, 2006; Pethiyagoda *et al.*, 2006).

The Sri Lanka amphibian diversity is very high due to the varied geology, altitude, climate, geography and habitats which support a wide distribution. Sri Lanka has various ecological zones, i.e., dry zone, intermediate zone and wet zone. Most of the species are recognized by lowland wet zone rain forest and vegetational floristic region (Bambaradeniya *et al.*, 2003; Gunatillake & Gunatillake, 1990). The Sri Lanka amphibian fauna may also be grouped by their habitats, such as arboreal, burrowing, terrestrial and aquatic. According to the De Silva (1994) and Wijesinghe & Dayawansa (2002), the endemic species belonging to these four groups are found in the wet zone rain forest. Sri Lanka has been fortunate as a fair proportion of their natural habitats are found throughout the wet zone rain forest.

Sri Lanka's natural forest areas still constitute over 12% of the total land area (Tan, 2005). The natural forests in the island are rapidly diminishing as a result of the expansion of settlements and agricultural land, leading to adverse impacts on the rich biodiversity (Bambaradeniya *et al.*, 2003). The loss of natural forests over the past 100 years has led to the extinction of seventeen species of scrub frogs *Philautus* spp. (Manamendra-Arachchi & Pethiyagoda, 2005). One of the biggest drawbacks for conserving amphibian fauna of the country is the lack of knowledge of their distribution and ecology. Therefore, we believe this paper would contribute to and enhance the current knowledge of amphibian diversity within the Beraliya Mukalana Proposed Forest Reserve.

Study area

The Beraliya Mukalana Proposed Forest Reserve (BMPFR) area belongs to Alpitiya and Niyagama secretariat divisions of Galle District, between the northern latitudes 6°14' and 6°18' and eastern longitudes 80°11' and 80°14' (Somasekaran, 1988). The study area is accessible via the Alpitiya – Pitigala main road in the northern part and the Alpitiya – Waturuvila main road in the southern part (7 km from Alpitiya town junction). The Beraliya Mukalana forest covers 4,639 hectares and falls in the southwestern wet zone. This area has a several small mountains, Atuwagala Kanda being the highest mountain at 540 feet, and the forest area is 400 feet above sea level. The forest reserve receives the southwestern monsoon and the annual rainfall is 3,660 mm and the average annual temperature is 28°C. The BMPFR vegetation can be categorized as lowland evergreen rain forest (Gunatillake & Gunatillake, 1990) and has a rich biodiversity like any other

rain forest in the area. The study area has a rich floristic diversity and its composition is a very good evidence for identifying a primary rain forest (Ashton *et al.*, 1997).

Methodology

The present study was carried out during 2004 and 2005. A total of 16 days were spent for fieldwork during the two years. General area surveys were carried out in different habitat types within the BMPFR. Surveys were conducted both day and night. All amphibian habitats such as water bodies, under rocks, logs and decaying vegetation, and in trees and bushes for arboreal amphibians were thoroughly searched for the presence of specimens. All collected species were examined carefully and noted down before being released back to the same habitats. The diagnostic keys given by Dutta and Manamendra-Arachchi (1996), Manamendra-Arachchi & Pethiyagoda (1998), Manamendra-Arachchi and Pethiyagoda (2005) and Manamendra-Arachchi and Pethiyagoda (2006) were used for species identification. Basic environmental parameters were recorded at the locations where specimens were collected.

Results

During the survey, 22 species of amphibians belonging to four families consisting of 14 genera, including 11 endemic amphibian species, were recorded in BMPFR. Species from the endemic genus *Lankanectes*, *Nannophrys*, *Adenomus* were found in BMPFR. Most of the species were recorded during the rainy season, especially in the well-shaded canopy covered areas. Several species were also recorded within the home gardens dominated by Areca-nut plants (*Areca catechu*). Among the 22 species, only one species represented the caecilians.

The most common and abundant species present in BMPFR are: *Bufo melanostictus*, *Microhyla rubra*, *Limnectes limnocharis*, *Euphlyctis cyanophlyctis*, *E. hexodactyla*, and *Hoplobatrachus crassus*. Caecilians were the least abundant (5%). Atukorale's Toad (*Bufo atukoralei*), *Bufo noellerti*, *Philautus cavirostris*, *Polypedates cruciger*, *Polypedates longinasus* and

Yellow Banded Caecilian (*Ichthyophis glutinosus*) are also occasionally found within the forest. Ten species recorded from BMPFR are considered as nationally threatened in IUCN-Sri Lanka's **1999 Red List of Threatened Fauna and Flora of Sri Lanka** national status report.

Discussion

Adinomus kelaartii was observed during both day and night, usually in close proximity to streams. It is a semi-arboreal species and inhabits rock boulders in streams (Manamendra-Arachchi, 2000). They were mostly found at ground level. Three specimens of *Bufo atukoralei* were recorded from a single locality in a home garden habitat. The common house toad *Bufo melanostictus* is a widely distributed and commonly found nocturnal species in the study area. It is mainly seen in cleared or disturbed habitats in home gardens, and rarely found inside the forest. Two specimens were seen inside the forest and 17 specimens were observed outside the forest near decaying logs and with rocky surfaces. *Bufo noellerti* is a terrestrial species and is rarely recorded near human habitations (Manamendra-Arachchi & Pethiyagoda, 1998). We also observed this species in trees about 1m above ground level in wet barks.

Common bull frog *Kaloula taprobanica* is a commonly seen species and it is recorded from human settlements such as in home gardens and agricultural lands. *Microhyla rubra* and *Ramanella variegata* appear to be uncommon in this forest, as they were recorded from a single locality. Their calls were heard near a temporary pool during the rainy season. Many of them were heard calling from the grass. About 13 specimens of Red narrow mouth frog were recorded in this area. Kandamby (2001) recorded 22 amphibian species from Galle District. However, two *Philautus* species were mistakenly identified as these two species are extinct in Sri Lanka. The White-bellied pug snout frog is an uncommon Microhylid frog that was recorded in the survey, and is mostly seen during the night time. Three specimens were recorded in the home gardens under rocks and inside the houses.

Hoplobatrachus crassus is the largest of the Sri Lankan frogs and very common in this area. Nine adults and 10 juveniles were seen near the streams. A juvenile with a yellowish green color line on the vertebral area and around the eyes was observed crossing a forest path at night. A smaller percentage was recorded from the paddy field. *Fejervarya limnocharis* is another very common species recorded from the grassland near temporary small ponds, pools and paddy fields. They are seen in large numbers everywhere in the study area. *Euphlyctis cyanophlyctis* and *Euphlyctis hexodactyla* are very common species and were recorded from temporary rain water pools and ponds inside the BMPFR; 24 specimens were recorded from this area. The Sri Lanka wood frog *Rana gracilis* is rare in this area; it is terrestrial or partly arboreal in habit and occasionally seen in small numbers sitting on the sides of the paddy fields and inside the wells. It is active during the night and during the daytime is seen resting under the rocks.

Rana temporalis was found in rocky habitats with streams and in the leaf litter in the rain forest throughout the wet zone. *Lankanectes corrugatus* has been recorded on the margins of slow flowing streams, in rocky areas of streams as well as in leaf debris. This species is essentially a submontane one, being recorded from the lower foothills. *Nannophrys ceylonensis* was rare and its distribution is restricted to the low country wet zone forest. They were found mainly under boulders and on wet flat rocky surfaces (Cascade habitats). *Rana auratiaca* is a semi-arboreal species which was seen under wet logs and on the leaf litter layer. It was also recorded near slow flowing streams and pools surrounding very damp substrates.

The tubercle shrub frog *Philautus cavirostris* was recorded three times resting inside the monastery lavatory. In addition, this species was recorded in Dediyaigala, Kanneliya in Galle District (Kandamby & Batiwita, 2001). *Philautus hoipolloi* is a common species in this area and the male's call can be heard 1-2m above ground level. The nesting behavior of this species was also documented; 17 eggs were laid in a 1-2 cm hole dug by the female. Common Hourglass Tree Frog *Polypedates cruciger* was frequently recorded

within the human settlements but was not observed within the forest areas. The Chunam Tree Frog *Polypedates maculatus* is also recorded from the home gardens. Their calls were heard at night from the trees adjoining the small pools about 10 feet above ground level. A total of 18 specimens were recorded from the study area. *Ichchiophis glutinosus* is very rare in this area; it was found only one time near Deniya Oya. This species is usually found in daytime under big wet logs.

Conclusions and recommendations

Preliminary indications are that the BMPFR site is of high amphibian diversity interest and importance. However, the survey period was short and it is recommended that similar more long-term surveys be conducted. Habitat loss and deterioration remain the predominant threats to BMPFR amphibian populations. Tree frogs, especially of the genus *Philautus* and *Polypedates longinasus*, show patchy distribution due to their specificity of habitat. The slash and burn technique of shifting cultivation involves the cutting of forest patches for agricultural practices, which destroys the habitat of *Philautus*.

This and other human activities involving cutting of trees will contribute to decline of such arboreal species of anurans. An advantage which has perhaps been overlooked as regards monitoring by members of the local communities is that it helps to raise awareness of the value of species and habitats. If this awareness can be integrated into conservation and management effects, then the likelihood of biodiversity conservation is higher than otherwise might be the case.

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(continued on p.15)

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Table 1: List of Amphibian species recoded from the Beraliya Mukalana Proposed Forest Reserve. (Abbreviations: TR – Threatened Species and E – Endemic species)

Family and Scientific name	Common name	Status
Family :- Bufonidae		
01 <i>Adenomus kelaartii</i>	Kelaart's dwarf toad	E / TR
02 <i>Bufo atukoralei</i>	Atukorale's dwarf toad	E / TR
03 <i>Bufo melanostictus</i>	Common house toad	
04 <i>Bufo noellerti</i>	Nollert's toad	E / TR
Family :- Microhylidae		
05 <i>Kaloula taprobanica</i>	Common bull frog	
06 <i>Microhyla rubra</i>	Red narrow mouth frog	
07 <i>Ramanella variegata</i>	White-bellied pugsnout frog	
Family :- Ranidae		
08 <i>Euphlyctis cyanophlyctis</i>	Skipper frog	
09 <i>Euphlyctis hexadactylus</i>	Sixtoe green frog	
10 <i>Fejervarya limnocharis</i>	Common paddy field frog	
11 <i>Hoplobatrachus crassus</i>	Jerdon's bull frog	
12 <i>Lankanectes corrugatus</i>	Corrugated water frog	E / TR
13 <i>Nannophrys ceylonensis</i>	Sri Lanka rock frog	E / TR
14 <i>Rana aurantiaca</i>	Small wood frog	TR
15 <i>Rana gracilis</i>	Sri Lanka wood frog	E / TR
16 <i>Rana temporalis</i>	Common wood frog	
17 <i>Philautus hoipolloi</i>	Home Garden's Shrub frog	E
18 <i>Philautus cavirostris</i>	Tubercle shrub frog	E
19 <i>Polypedates cruciger</i>	Common hour-glass tree frog	E / TR
20 <i>Polypedates longinasus</i>	Sharp-snout saddled tree frog	E / TR
21 <i>Polypedates maculatus</i>	Chunam tree frog	
Family :- Ichthyophiidae		
22 <i>Ichthyophis glutinosus</i>	Common yellow-band caecilian	E / TR

DRY MATTER AND ORGANIC VALUE OF CUSCUS DIET IN WEST PAPUA

by Sepus Fatem, Diana Sawen and Matheus St. E. Kilmaskossu

Introduction

One of the endemic animals of Papua is the cuscus. The cuscus is generally well known by society as it is hunted for its meat to fulfill people's nutritional needs. In addition, its fur can be used for many high value ornaments and handicrafts such as bags, caps, hats and purses. However, uncontrolled hunting, rapid development and increases in the human population will endanger the cuscus.

One effort to overcome these pressures is raising cuscus in captivity (cuscus farming). An important factor in successfully raising cuscus is knowing its diet, as the farm conditions should imitate their natural habitat, both the climate and food species. In captivity, the food should be similar to that found in their natural habitat. The cuscus feed on plants that mostly consist of harsh fiber, although they also often feed on small vertebrates such as lizards, insects, etc.

The food value or diet of cuscus is very important and needs to be known, as this can prevent the failure of conservation activities. The correct diet or food is very important for growth and development, e.g. to replace the old dead cells by producing new cells, for reproduction, etc. (Widayati *et al.*, 1996).

Menzies (1991) mentioned that in cuscus farming in Papua New Guinea, cuscus that are fed plants of low harsh fiber content (generally fruits) mostly die due to intestinal ailments (e.g., infections).

Based on the above, the *ex situ* conservation efforts for cuscus should pay more attention to the dietary factors and provide food or feeding plants derived from the native habitat. Therefore, research is needed to determine the nutritional

values (i.e., the dry matter content and organic matter content) of cuscus feeding plants in the northern shore area of Manokwari district, Papua.

Research method

This research study was conducted in Mandopi, Asai, Mubri, and Warbefor in the northern shore area of Manokwari district, and at the Nutrition and Food Laboratory of Livestock of FPPK UNIPA, from November 5-26, 2005. The method used is a descriptive method with field observation techniques, semi-structured interviews and laboratory analyses. Analyses of the organic and dry matter followed the steps referred to in the procedure of Apriyantono, Fardias, Puspita Sari, Sedarwati and Budiyanono (1989). Variables observed and noted were: type of feeding plants, parts of plants consumed, plant structure, and the nutritional values of dry and organic matter.

The observations showed that vegetation diversity is evenly distributed along the northern shore or coastal area of Manokwari district. This includes the cuscus feeding plants. The cuscus feeding plants are easily found as they almost form a forest complex along the coast inlands up to 50 m above sea level. They are found in beach or littoral forest as well as in the lowland tropical rain forest.

About 34 plant species from 28 families are consumed by cuscus. These include 6 agricultural crop/plants and 28 forest plants. The results also indicate that among the two cuscus species that live in this area – Gray cuscus (*Phalanger orientalis*) and Short-tailed spotted cuscus (*Spiloglossus maculates*) – there is no difference in terms of the type of food consumed. The parts of plants being consumed are young leaves or shoots, ripe fruits, husk of fruits and inflorescence.

Fruits are preferred as they have a high content of fiber and water, which favors digestion.

Ripe fruits from 26 plant species and the leaves and shoots from another 8 species are consumed

by cuscus. For some food plants the cuscus only feed on the young leaves or ripe fruits. However, there are other plants of which the cuscus consumes the young shoots and ripe fruits or young shoots and inflorescence.

Table 1: Plant species and parts of plants consumed by cuscus

Family	Latin name	Parts of plant consumed
Mimosaceae	<i>Leucaena glauca</i>	Young leaves/shoots
Myrtaceae	<i>Eugenia</i> sp ¹	Ripe fruits
Myrtaceae	<i>Eugenia</i> sp ²	Ripe fruits
Myrtaceae	<i>Psidium guajava</i>	Ripe fruits
Sterculiaceae	<i>Theobroma cacao</i>	Ripe fruits
Gnetaceae	<i>Gnetum gnemon</i>	Ripe fruits and Young leaves
Combretaceae	<i>Terminalia cattapa</i>	Ripe fruits and Young leaves
Convolvulaceae	<i>Merremia peltata</i>	Young leaves
Fabaceae	<i>Intsia bijuga</i>	Young leaves
Papilionaceae	<i>Pongamia pinnata</i>	Young leaves
Sapindaceae	<i>Spondias dulcis</i>	Ripe fruits and Young leaves
Sapindaceae	<i>Pometia pinnata</i>	Ripe fruits and Young leaves
Lauraceae	<i>Persea americana</i>	Ripe fruits
Zingiberaceae	<i>Globo</i> sp ¹	Ripe fruits
Zingiberaceae	<i>Globo</i> sp ²	Ripe fruits
Caricaceae	<i>Caricca</i> sp	Ripe fruits
Musaceae	<i>Musa</i> sp	Ripe fruits and Young leaves
Muntingiaceae	<i>Muntingia calabura</i>	Ripe fruits
Anacardiaceae	<i>Mangifera indica</i>	Ripe fruits
Myristicaceae	<i>Horsfieldia globularis</i>	Ripe fruits
Moraceae	<i>Ficus</i> sp	Ripe fruits
Moraceae	<i>Ficus septica</i>	Ripe fruits
Moraceae	<i>Ficus trachypison</i>	Ripe fruits
Moraceae	<i>Ficus macrothyrea</i>	Ripe fruits
Meliaceae	<i>Lansium domesticum</i>	Ripe fruits
Pandanaceae	<i>Pandanus polycephalus</i>	Ripe fruits
Clusiaceae	<i>Calophyllum inophyllum</i>	Young leaves
Clusiaceae	<i>Morinda citrifolia</i>	Ripe fruits
Flacourtiaceae	<i>Flacourtia inermis</i>	Ripe fruits
Aracaceae	<i>Philodendron</i> sp	Ripe fruits
Apocynaceae	<i>Lepinopsis ternatensis</i>	Young leaves
Sapotaceae	<i>Palaquium amboinensis</i>	Young leaves
Sapindaceae	<i>Geniostoma</i> sp	Ripe fruits
Sapindaceae	<i>Nephelium lapaceum</i>	Ripe fruits

Figure 1: Food plants of cuscus



Pongamia pinnata



Philidendron sp.



Palaquium ambionensis



Pandanus polycephalus



Horsfeldia globularis



Ficus macrothyera



Ficus trachypison



Meremia peltata



Globa sp.



Ficus sp.



Calophyllum inophyllum



Globa sp.

Nutritional value

Dry matter content

The water content of food is calculated by the difference between the foodstuff's weight before heating and after heating, divided by foodstuff's weight before heating.

The dry matter content of the plant part consumed by cuscus, in this case ripe fruits, ranges from 7.81%-57.78%, while for young shoots it ranges from 14.99%-49.6%. The highest dry matter content is that of Globak fruits (*Globa* sp.) 57.78 % and red Globak (*Globa* sp.) 51.37 %. The ripened fruits usually show a high dry matter content; however, some, like Jambu (*Eugenia* sp.), show a low dry water content.

The high dry matter content of *Globa* sp. is perhaps due to a high carbohydrate content and it can be seen that the fruits are more solid, have a low water content, and taste sweet (can also be consumed by humans). According to Salisbury and Ross (1995), the main component of dry matter is the polysaccharides and lignin of the cell walls, added to the cytoplasm components like proteins, lipids, amino acids, organic acids and certain specific minerals like potassium.

The nutritional status of plants is very much determined by the dry matter content, because dry matter contains much nutrition; thus, dry matter can show which parts of a food plant can be consumed by cattle or wildlife (Subagyo and Kusmartono, 1988). This matches the opinion of Reksodiprodjo (1988), who stated that the dry matter content of a food species determines the nutritional content of the species, where the higher the dry matter content, the higher its organic matter will be.

The dry matter content of young leaves or shoots is sufficiently high as shown by matoa shoots (49.60%). This might be due to the fact that it is in the leaves where photosynthesis occurs and produces a lot of protein and energy. This is in line with Salisbury and Ross (1995), who mentioned that, in general, the leaves contain much more nitrogen, phosphorus and potassium.

Organic matter content

In a food-stuff analysis, the organic matter content is considered to be the total amount of nutrition, protein, fat, harsh fiber, and energy. Therefore, it does not show or indicate the types of food. This result is derived from the analysis of the ash content after the incineration process.

The organic matter content of forest plants and agricultural plants varies depending on the parts of the plant being consumed. The highest organic matter content is that of *Globa* (*Globa* sp) (52.31%), while for young leaves or shoots it is *Pometia pinnata* shoots (46.6%).

The high organic matter content of *Globa* sp may be due to its solidness. Physically, when the fruit is ripe, the flesh is more compact and not watery. This differs from other fruits which when ripe have a high water content. The dry matter content is parallel or has a linear relation to the organic matter content, which means that if a certain food plant has a high dry matter content, then the organic matter content tends to also be high.

Young leaves or shoots also have a high organic matter content. This might be due to the fact that it is in the leaves where photosynthesis takes place. This fits with the statement of Djoseputra (1992) that in the photosynthesis process, plants will use the carbon from the air to change it into organic matter and distribute it to other parts of the plant.

Conclusion

The total number of plant species consumed by cuscus in the northern shore area of Manokwari district consists of 34 species from 28 families; 6 families are agricultural plants and 28 families are forest plants.

The highest dry matter content of food plants consumed by cuscus comes from ripe fruit of *Globa* sp (57.78%), while the lowest is from ripe Jambu fruit (*Eugenia* sp) (7.81%). Among young leaves or shoots Matoa (*Pometia* sp) has the highest dry matter content of 49.6%, while the lowest content is from shoots of Kedondong (*Spondias dulcis*) with 14.19 % dry matter content.

The highest organic matter content is found in the fruit of *Globa* sp. (52.31%), while the lowest

organic matter content is found in ripe fruits of *Spondias dulcis* (4.39%). Among young leaves or shoots, *Pometia* sp. has the highest organic matter content of 46.6 %, and the lowest is found in the vine *Meremia peltata* with 4.38 %.

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COMMUNITY-BASED ECO-TOURISM: A CASE STUDY OF TAMAN SAFARI INDONESIA

by Govindasamy Agoramoorthy

Introduction

Ecotourism involving wildlife and nature has been considered one of the fastest growing sectors of the tourism industry in recent decades. It has been promoted widely to complement the conservation of highly endangered species and habitats in developing countries in Asia, Africa and South America (Campbell, 1999, 2002). Southeast Asia is considered a major biodiversity hotspot and is known to harbor immense diversity of fauna and flora, including several highly endangered and endemic species (Myers *et al.*, 2000). Thus, sustainable tourism to promote the local economy

and to upgrade the socio-economic status of the rural people is essential so that people can be educated about conservation and hopefully eventually safeguard the dwindling natural resources. In this paper, information is provided regarding the role of a wildlife safari park in Indonesia in promoting sustainable development, education and nature conservation in the community.

Materials and methods

Taman Safari Indonesia (1992) is a wild animal theme park and was opened in 1986 as the first

open wildlife park in Indonesia. It is located in Cibereum village (Cisarua town, Bogor, West Java), in the northern part of the Gede Pangrango National Park (Harris, 1994). The mountainous terrain was a tea plantation during the Dutch colonial period. The park lies about 80 km from Jakarta city. The cool climate offers relief from the capital's often oppressive heat. Year-round temperatures at the park vary between 18-24° C.

The park displays about 2,300 wild animals and is partly a modern zoo with a back-to-nature theme where animals are allowed to roam freely in spacious exhibits. It also operates a Night Safari (established in 2000) four days a week, and a Safari Trek (established in 2001) that operates daily. Visitors trek through the rainforest for 8 km and it promotes appreciation of nature and endangered species. It is also a conservation center with an emphasis on ensuring the long-term survival of indigenous wildlife. The park serves as a buffer zone for the adjoining Gede Pangrango National Park where wild leopards, Javan gibbons and Javan deer roam freely. The Pangrango Mountain is a World Heritage site.

Taman Safari Indonesia was visited 6 times between 15 November 2004 and 20 April 2005 (4-6 days per visit) to collect data related to wildlife tourism, sustainable community development and conservation education. Data on the number of visitors were pooled from the park's archives. Cibereum village was visited to compile data on the community. A questionnaire survey was conducted and 2,800 visitors were surveyed to gather data on the role of the safari park as an educational institution and to promote sustainable development for the local community. The survey targeted the following basic questions to the visitors: (i) Age of visitors; (ii) origin of visitors (name of village, town, city); (iii) monthly income of visitors; (iv) educational background of visitors; (v) number of visits to the park by visitors per year; (vi) transportation used to reach the park; (vii) best attraction at the park; (viii) reason for visiting the park; (ix) visitors' opinion about animal shows; (x) visitors' opinion about staff and response; (xi) visitors' opinion about the park's environment; (xii) whether or not visitors gained new knowledge about wildlife and conservation; (xiii) whether or not visitors satisfied about their

visit; (xiv) visitors' opinion on future attractions; and (xv) whether or not visitors contribute for conservation in future. The directors of the park were interviewed to collect information using *ad-libitum* sampling (Lehner, 1996) on the contributions of the park to the local community. The questionnaire responses of visitors were analyzed qualitatively (Sudman and Bradburn, 1982).

Results and discussion

The majority of the visitors to the park belonged to the age group between 31 and 50 years, followed by young adults in the age group 18 to 30 years (37%). This indicates that young and middle-age adults were eager to learn about wildlife in general. People over 50 years and younger individuals below the age of 18 comprised the lowest proportion of park visitors (7% each). The park attracted mostly local visitors (99%) with few foreigners. This may be due to the media coverage of social, ethnic and religious unrest, including potential terrorism, that often discourages foreign tourists to visit Indonesia (Leggat & Leggat, 2004; Simon, 2005). The majority of the local visitors, however, came from Jakarta city (37%), followed by outside the Jakarta area (29%), Bogor (25%), and Bandung. For the urban dwellers of Jakarta and other major cities in Indonesia, pollution is an apparent health hazard (Duki *et al.*, 2003). Visiting the park is usually a day-trip where tourists spend their time in a pollution-free natural environment to view a variety of wildlife and also to learn about animals.

The majority (44%) of the visitors to the park earned on the average USD 100 to 200 per month, followed by visitors earning an average USD 200 per month. Those who earned less than USD 100 per month constituted only 24% of the visitor population. In addition, park visitors generally had minimum education qualifications of senior high school (44%) and university education (35%). This indicates that people from the upper-and middle-class who earn a reasonable income were willing to spend their time and money to visit the park to learn about wildlife and nature. Interestingly, 35% of the visitors had been to the park more than 3-5 times and 91% of them own automobiles. Thus, the park attracts repeat visitors who have a unique

opportunity to learn about wildlife conservation which might eventually promote conservation awareness. Educating visitors about wildlife has in fact increased awareness and contributions towards wildlife conservation in the world (Luck, 2003).

When asked what part of the park attracted the visitors most, the response was mainly the diversity of the animal collection (47%). This was followed by animal shows (29%) and recreational activities (13). A lot of visitors were attracted towards various shows that involve animals such as cowboy shows, dolphin shows, elephant shows and various animals shows. When asked about their interest in such shows the majority responded that they attended the shows to increase their knowledge about wildlife (74%). Although showing animals in zoos and safari parks, especially non-human primates, often involve abuse and animal suffering (Agoramoorthy and Hsu, 2005), the park's animal interaction programs are aimed at educating the public about animal welfare and the urgent need to protect and preserve the dwindling wildlife populations in Indonesia. Some answered that they care about wildlife (15%), while others responded that they would like to contribute to the conservation of wildlife (11%). This indicates that the park in fact is serving as a vehicle to promote nature and wildlife conservation to the local community. It supports the notion that conserving the biological resources of our planet can come about only through informed and educated citizens who are able to place conservation into social, political and economic contexts at local and international levels (Agoramoorthy, 1997). As pointed out by Jacobson (1995), conservation education and communication at all levels are perhaps our only hope for the future to safeguard the diminishing natural resources.

When asked whether they thought the park maintained a clean and garbage-free environment, the majority responded by stating that the park was 'very good' (60%), while others said 'good' (37%) and only 3% stated 'not really good'. It indicates that the visitors perceive that the park maintains a pollution-free natural environment in general, which is essential to educate the local people since cities such as Jakarta suffer environmental degradation and pollution (Duki *et*

al., 2003). 98% of the visitors said that they gained knowledge about wildlife after visiting the park, which indicates that the park serves as an educational institution to spread the nature conservation message. The majority of the visitors (78%) were also satisfied with the money they spent to visit the park to learn about wildlife. When asked what new attractions the visitors would like to see in the future, the responses ranged from improving the animal collection (55%), followed by increase in amusement activities for children (19%), to adding more animal shows for recreation (26%). This indicates that local people want to see a variety of animals in a natural environment so that they can increase their knowledge about the natural history of wild animals.

The park is located near a small village named Cibeureum, adjoining the town of Cisarua near Bogor city. The village has an area of 112,862 ha with 11,674 residents, including 5,954 men and 5,720 women. The safari park has contributed to the sustainable development of Cibeureum village and Cisarua town in general for a decade. It continues to provide social aids each year and also supports educational, religious, public utilities and community programs. The park has a total of 648 employees, of which 305 come from Cisarua District adjoining the park. An additional 88 staff come from Bogor city, while 263 come from other parts of Indonesia. The park assists in the development of religious service houses such as mosques and gives donations and gifts to the local Muslim community during the feast day of Ramadan each year. It also assists the local government and community to build and maintain public roads, streets, street lights, toilets, and security posts. It provides transportation services for the countryside, donates uniforms for public transport drivers and jackets, vests and helmets to motorcycle drivers in the community. Moreover, it supports building new classrooms, renovating school buildings, providing furniture and computers annually to local schools. Students and teachers are allowed to visit the park free of charge. This supports the fact that wildlife tourism involving a safari park can also benefit the local community similar to protected area ecotourism, which is becoming common in developing countries (Heinen, 1993; Fiallo and Jacobson, 1995; Walpole and Goodwin, 2001).

The park receives thousands of visitors during the day and also at the night safari. Many visitors participate in trekking through the natural forest. Since a large number of visitors come to the park both during the weekdays and weekends, it provides an opportunity for the community to sell locally grown vegetables and fruits that can be used as animal feed at the park. Local people also sell handicrafts and souvenirs to visitors and assist in the traffic control of automobiles, clean cars, and also provide parking facilities. During weekends, students find part-time work at the park or in other businesses outside the park. All these activities provide additional income for the local community. Furthermore, the park provides loans to merchants who sell vegetables and fruits through the local Bank of Danamon. The park played a major role in the establishment of the Indonesian Forum for Wildlife Conservation in 1998, which is non-profit agency whose members are journalists, bureaucrats, researchers, entrepreneurs, academicians, activists and officials from both the public and private sectors. The activities include advocacy, conservation campaigns and promoting conservation awareness among public.

Many wildlife species native to Indonesia are represented in the park's collection, including two animals that are only found on the island of Sulawesi. They are the anoa, a dwarf water buffalo, and the babirusa, which appears to have evolved from wild pigs some 30 million years ago. The park serves as a conservation center to breed various local species, including the highly endangered Sumatran tigers and Sumatran orangutans. The park had a total of 35 breeding Sumatran tigers as of 2005 and has a repository of the sperm of seven others for the future use to make sure that inbreeding does not occur. The park has also managed to re-introduce the highly endangered Bali starlings back into the wild. Over a hundred species of wild birds can be seen in the safari park and some fifteen species are classified as very rare and are on the endangered species list. The adjoining forest also harbors one of the rarest primates, the Javan or silvery gibbon, which is considered one of the top 25 highly endangered primates in the world (Conservation International, 2002).

In developing countries, natural habitats have been fast disappearing due to the increase in human population density, continued habitat destruction, agricultural expansion, industrial development, and other man-made disturbances (Cincotta *et al.*, 2000). The tropical islands in Southeast Asia that harbor a vast diversity of natural resources are more vulnerable to habitat destruction leading to species extinction (Agoramoorthy and Hsu, 2001a). This is mainly due to the fact that the Asia-Pacific region has 23% of the world's land area and 58% of the world's population (Agoramoorthy and Hsu, 2001b). If countries such as Indonesia that harbor high human density (121 million people; 914 people/km²; (Badan Pusat Statistik, 2004)) need to conserve natural habitats, fundamental changes are necessary to integrate nature conservation through the kind of sustainable tourism that has been outlined in this paper to promote the local economy and to upgrade the socio-economic status of the rural poor.

Tourism as a wildlife conservation and sustainable development tool can be promoted, and from a community perspective it is expected to provide benefits that ultimately enhance local support for the conservation of natural resources (Goodwin, 1996). The results of the study did not reveal any negative attitudes about tourism at Taman Safari Indonesia, but patterns of attitude involving tourism and wildlife conservation may change in the future as tourism develops (Doxey, 1975). Therefore, further studies will be needed in the future to gather quantitative data on the performance of tourism at the safari park in terms of ecological, socioeconomic, and community conservation levels.

In the case of Taman Safari Indonesia, the local community certainly benefits from the park through employment and other benefits to boost infrastructure, including alleviating poverty in the rural village community. Furthermore, the park protects the adjoining Gede Pangrango National Park from encroachment and destruction by local villagers. It also promotes conservation awareness among the rural and urban community in Java, which has a long history of cultivation and deforestation.

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Figure 1. Local villagers and children sell carrots to the visitors to be fed to herbivores at Taman Safari Indonesia



Table 1: Number of visitors to Taman Safari Indonesia between 2000 and 2004

Year	No. of Visitors
2000	1,601,977
2001	1,667,206
2002	1,556,264
2003	1,629,243
2004	1,373,965

Table 2: Community organization of Cibereum Village near Taman Safari Indonesia

Community information	Area/Number
Land area	112,862 ha
Human population	11,674
Male	5,954
Female	5,720
Rice field	4 ha
Hill	125 ha
Fish pond	1 ha
Horse	6
Sheep	300
Rabbit	169
Chicken	4,750
Cattle farm	112
Co-operative market	2
Grocery shops	5
Small shops	514
Mini-market	2
Traditional market	2
Recreational park	1
Real estate	1
Hotel	16
Restaurant	5
Car service	6
Motorcycle service	2
Telecommunication	31
Tennis court	16
Badminton court	5
Volleyball court	1
Football court	2
Swimming pool	25
Mosques	17
Small mosques	22
Islamic organizations	22
Church	1
Hindu temple	1
Hospital	1
Clinic	1

RESIGHTING OF INDIAN OR GREATER FALSE VAMPIRE IN KODINAR, JUNAGADH DISTRICT OF GUJARAT

by L. Muthu Andavan, Manojkumar Pardeshi, Justus Joshua and S.F. Wesley Sunderraj

The Indian or greater false vampire (*Megaderma lyra*) belongs to Family Megadermatidae and is distributed throughout India. It is not uncommon in the Himalayas and deserts, in caves, forests, and near human dwellings with a range extending to Mumbai (Menon, 2003). In Gujarat, this species has been reported to be found in Amdavad district, Banaskantha district (Ryley, 1914), Dangs district, Kheda district and Surat district (Sinha, 1981) and throughout the mainland of India (Baqri, 2000).

The presence of this species in Junagadh district in Gujarat was reported by Brosset (1962), but has not been reported from any part of the forest of this region since then. During our environmental impact assessment survey in the Kodinar area of Junagardh, we sighted 15–25 individuals of greater or false vampire near Tordi village at 6:18 pm between the geographic co-ordinates 20°47' 28.6" N, 70°35' 58.0" E, at 16 m above msl in the cavy sacred grove. The grove was partially surrounded by agricultural land and trees species such as *Acacia*, *Ficus bengalensis*, *F. religisco*, *Prosopis*, etc., and sparse shrub and ground vegetation.

A photograph taken by the authors helped to confirm the identity and presence of this species in this region. Our sighting of the greater false

vampire is the first report of its presence from this region since 1962. It would also be of significance from the biodiversity conservation point of view as this would aid in updating the distribution of this species.

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