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Table 1. Activity periods of captured birds as recorded by camera traps in Phu Khieo Wildlife Sanctuary, Thailand, from February 2001—July 2002.

Species	Scientific Name	n	%Nocturnal	%Diurnal (n)	Activity
Blue Magpie	*Urocissa*	1	0	100 (1)	NA
	erythrorhyncha	1	0	100 (1)	NA
Chinese Pond Heron	*Ardeola Bacchus*	17	0	100 (17)	D*
Jungle Fowl	*Gallus gallus*	34	3 (1)	97 (33)	D*
Siamese Fireback Pheasant	*Lophura diardi*	1	0	100 (1)	NA
Silver Pheasant	*Lophura nycthemera*	1	0	100 (1)	NA
Coral-billed Ground Cuckoo	*Carpococcyx renauldi*				

Note: n=number of captures, D=diurnal, and NA=insufficient sample size.
 * Indicates significant designations of activity periods.

THE EXTIRPATION OF BALI AND JAVAN TIGER: LESSONS FROM THE PAST

by Mohammed A. Ashraf

Introduction

Its beauty, grace and power make the tiger (*Panthera tigris*) one of the world's most loved animals, yet it is precisely these qualities that have been its downfall (Seidensticker, 1999). More than a quarter of a century has passed since the tiger was first internationally recognized as being endangered and soon to be extinct in the wild if the forces resulting in its decline continued unabated. Over the ensuing years, considerable resources have been invested in saving the tiger with mixed results. Many small tiger populations are completely isolated, critically endangered and facing a bleak future. Entire subspecies from Bali, Java and areas in or around the Caspian Sea have not survived and have perished from the wild (Jackson & Kemf, 1999). This paper focuses on identifying the critical factors, both from ecological and socio-economical points of view, which led to the extirpation of Bali tiger (*Panthera tigris balica*) and Javan tiger (*Panthera tigris sondaica*) in the Indonesian islands of Bali and Java, and to utilize this knowledge to help conserve the Bengal tiger subspecies in Sundarbans mangrove forest in Bangladesh. The process (stochastic and deterministic) that led to the extirpation of Bali and Javan tigers might be the same could lead the tigers of the Sundarbans to the brink of extinction. This report attempts to gauge ecological perspectives at the genetic level for tiger conservation management in the Sundarbans, based on the science of wildlife biology and conservation genetics against the backdrop of the historical extirpation of island tigers of Indonesia – commonly known as Sunda Island tigers.

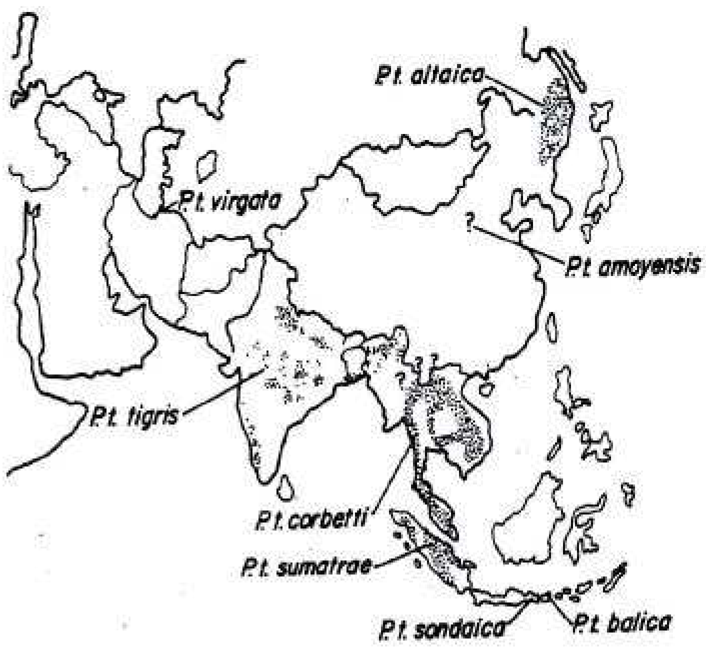
Conservation and population status

Concern for the tiger's survival in India and throughout its range was roundly expressed at the 1969 New Delhi meeting of the IUCN by a consensus of senior conservationists (S. Ali, Z. Futehally, J. C. Daniel, G. Mountfort, S.D. Ripley). Subsequently, in 1972, IUCN and its sister organization, the World Wildlife Fund, initiated "Operation Tiger" or "Save the Tiger" to raise funds, generate international public support and encourage national governments within the tiger's range countries to undertake their own action programs. By 1979, when representatives from most of the tiger range countries met in New Delhi at the first International Symposium on the tiger, wild populations of four subspecies, i.e. Bengal tiger, Indochinese tiger (*Panthera tigris corbetti*), Amur Tiger (*Panthera tigris altaica*) and Sumatran tiger (*Panthera tigris sumatrae*) – were declared relatively secure as long as the newly established conservation measures were maintained (Jackson, 1979). Populations of four subspecies – Caspian tiger (*Panthera tigris virgata*), South China tiger (*Panthera tigris amoyensis*), Javan tiger and Bali tiger – were either depleted or extinct.

Geographical distribution

Less than a century ago, tigers occupied a range extending from Turkey and the southern fringes of the Caspian Sea, eastward across Central Asia as far south through eastern China to the Indian sub-continent, and the whole of Southeast Asia as far as the Indonesian islands of Sumatra, Java and Bali. This former range has now contracted and been fragmented dramatically in recent decades (Jackson & Kemf, 1999). Tigers now occur only in scattered populations in parts of South Asia, Southeast Asia, Sumatra and the Russian Far East, with a small number possibly still surviving in China. The map delineates the geographic distribution of all the extant and extinct subspecies.

Fig.1: Geographical distribution of all the subspecies of tigers across its range countries



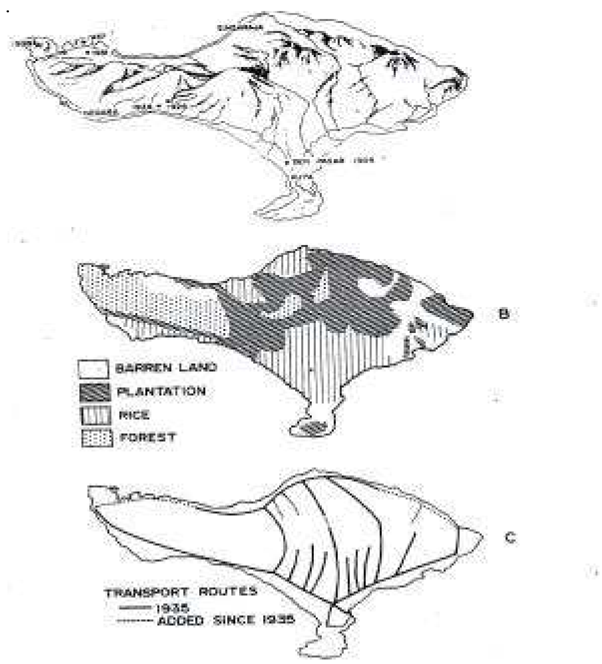


Fig. 2 Island of Bali, Indonesia: A: Shown are landforms and major cities where Dutch used to collect specimens of Bali tiger. B: Land use on Bali 1900s. C: The major roads already been developed in 1935

The extirpation of Bali tiger

The extirpation of the Bali tiger was largely attributed to the colonial development by the Dutch settlers in the Indonesian islands (Geertz, 1963). When the Dutch colonized Bali during the 1920-1930s, they pursued the indiscriminate hunting of the Bali tigers as part of their sports recreation pursuits (Ditdjen, 1971). Agricultural and road infrastructure development during the late 1800s and early 1900s also contributed to altering the land use and ecosystem fabric of Bali, thereby causing the tiger population decline.

The rich volcanic slopes, with their superb drainage and climate, made irrigation both technically possible and seasonally stable in Bali. The island's transportation network was strongly influenced by the grain of major gorges and spurs; east-west communications were difficult, hence road transportation developed in a north-south direction through the Bali terrain (Fig 2, C) (Sody, 1933; Ditdjen, 1971). All these agricultural and transportation developments, on top of the unrestrained hunting of Bali tigers, dramatically fragmented the large blocks of forested land that was the home of tigers in the island (Harper, 1945). The breeding territory of female tigers started to shrink, along with the prey population size. A single, continuous breeding population of tigers was soon restricted to a small isolated population amidst the booming development of agricultural and Dutch colonial landscapes (Seidensticker, 1978). By the end of the 1940s, the Bali tiger was gone from the wild forever. Later observations suggested that intense agricultural pressure massively altered the Bali landscape, thereby forcing the tigers to live in an isolated small population. Intense colonial hunting regimes by the Dutch, and no consensus for wildlife conservation by the public despite the stringent wildlife legislation, were also attributed as major factors that diminished the small but magnificent subspecies of tiger that once used to live in almost all parts of Bali Island.

The extirpation of Javan Tiger

The extinction of Javan tiger from the tropical lush Javan island was also largely attributed to the Dutch agricultural revolution from the late 1800s in the Island of Java (Seidensticker, 1978). From that time on, the Netherlands East Indies Company efficiently and systematically brought all remaining cultivated lands in Java under production (Greetz, 1963). Tigers and other wildlife declined, as forested areas, alluvial plains, and river basins were converted for use in agriculture.

In 1850, tigers were still widespread, although Harper (1945) reported that they were considered a nuisance. By 1940, tigers had disappeared from all but the most inaccessible island reaches. Much of the extensive monsoon forest areas where tigers had lived in east Java had been converted to teak plantations. This monoculture cash-crop cultivation significantly reduced the prey biomass contribution to the tiger's diet and hence the adult breeding tigers faced starvation. Prey depletion also brought humans into closer conflict with tigers. In the 1920s and 1930s a system of reserves was established in Java, but by the mid-1960s tigers survived in only three of these reserves. By 1970, tigers could only be found on the southeast coast known as Meru-Betiri. In 1976, there were at least three tigers living in Meru-Betri (Seidensticker and Suyono, 1980), but sadly, by the 1980s, competent observers failed to find any sign that the tiger had survived. From then on, Javan tiger was officially enlisted as an extinct species (Jackson, 1999).

Lessons from Indonesian tiger for conserving the Bengal tiger in the Sundarbans

The Bali and Javan tigers were protected by law and reserves to protect them had been established in the 1930s and early 1940s. So what went wrong that led to the complete extirpation of these two subspecies and what lessons we can learn from it to avoid the fate of the Bali and Javan tigers in the future? How does this account relate to the Bengal tiger population in the Sundarbans mangrove forest in Bangladesh and what conservation measures need to be adopted to safeguard the remaining sub-population of tigers in the Sundarbans? The author addresses these questions against the backdrop of the Sunda Island incident.

Like the islands of Bali and Java, the Sundarbans has long been isolated from any adjoining forest tracts or corridors (Seidensticker, 1986). Its tiger population is also an insular one, hence the factors (stochastic and anthropogenic) that led to the extinction of the Bali and Javan tigers are similar for the tigers of the Sundarbans mangrove ecosystem (Seidensticker, 1978). Widespread habitat fragmentation in Bali and Java isolated the tiger populations. In most cases, insular populations develop an inbreeding depression that can have a drastic impact on animal population viability in the long run (Ballou, 2004), commonly referred to as the population bottle-neck scenario. There is a great risk that tigers will eventually disappear from any small, isolated reserves through the effects of inbreeding depression, but the genetic diversity of the remaining subspecies of tigers in the wild is little known (Seidensticker, 1986). Connecting the small, isolated habitats through wildlife corridors is an effective sub-population (meta population) management strategy for sympatric large carnivores such as the tiger. It reduces the chances of inbreeding and increase the chances of outbreeding, hence strengthening the allelic diversity. Allelic diversity in turn ensures that species can better adapt to stochastic environmental changes that can lead to population decline or ultimate extinction. For example, the reserves where the last Javan tigers were found are small (<500 km^2) and insular, but in the 1930s when most where established, they were connected and thereby the population could disperse and inbreeding was avoided. The insular habitat (<500 km^2) in Java had no dispersal potential for transient Javan tigers and probably caused serious inbreeding, hence extinction was inevitable (Seidensticker, 1986).

Genetic diversity of tiger population in Sundarbans Forest in Bangladesh

The Sundarbans is the largest contiguous mangrove forest in the world. It is also the only mangrove ecosystem in the world that harbors a wild tiger population (Ashraf, 2005). An area covering approximately 10,000 km^2, encompassing areas in both Bangladesh (6,017 km^2) and India (4,000 km^2), it is a unique tiger habitat in terms of its habitat integrity, low poaching pressure and the current demographic status of tigers (Wikramanayake, 1999)). The Sundarbans is considered as a top priority Tiger Conservation Unit (TCU) according to the World Wildlife Fund (WWF) and Wildlife Conservation Society (WCS), USA (Wikramanayake, 1998). Since the genetic study of tigers in the wild is still in its infancy, the results of research to measure the allelic diversity, effective population size (Ne), and outbreeding rate of wild tigers in the Sundarbans are not yet known. Considering the deleterious impact of inbreeding on Bali and Javan tigers in the Sunda Islands (Sumatra, Java, Bali and Borneo) that resemble the Sundarbans, conducting basic ecological studies of tigers that at least address the distributional status of tigers in the protected areas of the Sundarbans is a central conservation concern (Ashraf, 2005). More advanced scientific studies that attempt to estimate the relative and absolute abundance of tigers need to be conducted in Sundarbans in order to determine the effective population size (Ne). The effective population size (Ne) is generally much less than the sample estimation size (N) of an unmanaged population – often only one-tenth (Ballou, 2004). A population study by the Bangladesh Forest Department and its associates reported an average tiger population size of 388. This is the average number of tigers in the Bangladesh Sundarbans, based on the infrequent demographic studies for over a quarter of a century (1971-2004). This gives us an average density of approximately 6 tigers per 100 km^2 in the Sundarbans. However, this is more likely to be an empirical density estimate with little or no scientific validation of the population survey design for meeting regular monitoring goals. Using the empirical census data of 388 tigers, we can theoretically calculate the effective population size (Ne) for the Sundarbans tigers. With our average 388 tigers, the effective population size (Ne) will be 38.80 (1/10th of the N) in Sundarbans. Ballou (2004) stated, "effective population size much greater than 50 is required to avoid inbreeding depression." Based on the average population size of tigers in the Sundarbans, we can conclude that the tiger population in Bangladesh is under grave threat at the very least from the deleterious impact of inbreeding in future. Therefore, more advanced studies that underpin the statistical framework to estimate ecological and genetic parameters of tigers (Karanth & Nichols, 2002) are an essential first step to safeguard the isolated population of tigers in the Bangladesh Sundarbans.

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Author's background: Mohammed Ashraf is a wildlife biologist with a keen interest in wild tiger populations and other endangered sympatric carnivore felids in tropical ecosystems. He is interested to form a tiger conservation forum with like-minded conservationists and biologists and can be contacted at the following email address: bengal_tiger010@yahoo.com

CURRENT STATUS OF OTTERS (MAMMALIA: LUTRINAE) IN VIETNAM WITH CONSERVATION IMPLICATIONS

by Nguyen Xuan Dang

Four species of otter have been recorded from Vietnam: the Asian small-clawed otter (*Aonyx cinerea*); smooth-coated otter (*Lutra perspicillata*); Eurasian otter (*L. lutra*); and the hairy-nosed otter (L. *sumatrana*). All four species were listed in 2004 in IUCN's **Red List of Threatened Species** (http://www.redlist.org) as follows: *Aonyx cinerea* – Nearly threatened (NT), *Lutra perspicillata* – Vulnerable (VU), *Lutra lutra* – Nearly threatened (NT), and *Lutra sumatrana* – Data Deficient (DD). In Vietnam, all otter species have declined and are facing the threat of extinction. Otters are protected by law in Vietnam; however, the lack of up-to-date scientific information on their status impedes the country's efforts to develop appropriate conservation strategies. This paper presents the status of four otter species in Vietnam based on the author's own study from 1998 to 2005, and also in the context of otter studies by other authors.

Vietnam has a land area of 330,541 km^2, extending for 3,360 km along the southeastern coastline of Asia, from 8°30'N to 23°00'N. About three-