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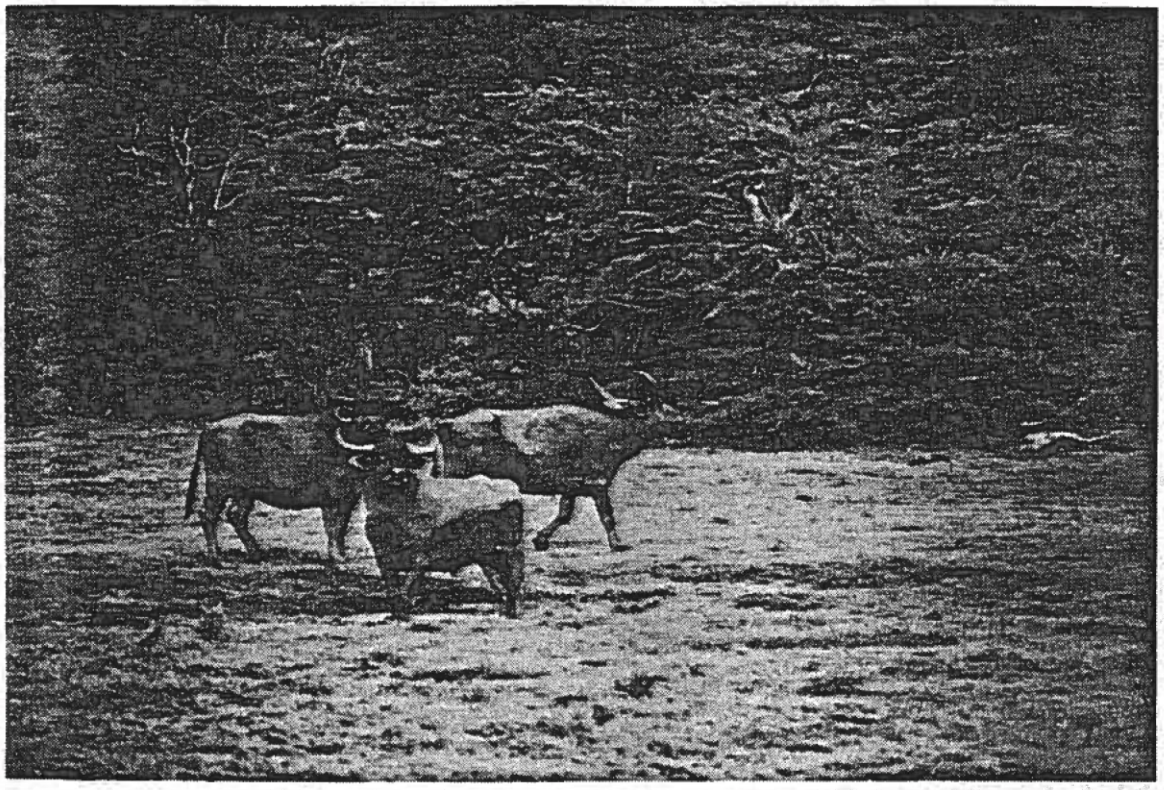
ASIAN WILD CATTLE SPECIALIST GROUP

NEWSLETTER



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Asian Wild Cattle Specialist Group NEWSLETTER
Number 4 **Autumn 1991**

WWF World Wide Fund For Nature

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The Asian Wild Cattle Specialist Group Newsletter is published with the following aims:-

- to highlight the plight of the Asian Wild Cattle
- to promote the conservation of the Asian Wild Cattle
- to provide a forum for communication amongst all the members

Newsworthy articles are invited for consideration for publication and should be sent to Dr Charles Santiapillai at WWF-Asia Programme, PO Box 133, Bogor, Indonesia. All articles may be reprinted. Reprinted articles should give credit to the Newsletter. The editors would appreciate receiving a copy of any article so used. The opinions expressed by the authors do not necessarily reflect the policies of either WWF or IUCN.

Cover: An adult male water buffalo with two adult cows in the Ruhuna National Park, Sri Lanka. (Photo: Charles Santiapillai).

COMMENT

There are a few modern conservationists who subscribe to the view that carrying out surveys is old fashioned and that recommendations that call for such surveys and emphasize the need for public education, translocation, habitat protection, *in-situ* conservation etc are of little value in achieving the desired conservation result. They argue that conservation strategies still need very much more work before they can be expected to have much impact and call for innovative thinking and the use of high-technology.

It is either a brave man or a foolish one who will dare belittle the value of public education in conservation. It was the strong protest voiced by a segment of the small but powerful, influential and enlightened public in Peninsular Malaysia that has to-date prevented the sale of such endangered species as the Sumatran rhinos to the western zoos and strongly advocated for the *in-situ* conservation of large mammals. There are many examples of strong public opinion responsible for the greening of the western countries recently to bring about the necessary legislation to deal with such environmental issues as acid rain, oil spills, nuclear waste disposal etc.

But as far as the wild cattle are concerned, in countries such as Laos, Cambodia and Vietnam, there is still a paramount need to know the distribution and population size of these mammals given the paucity of information that is available currently. The surveys carried out by Richard Salter and his Laotian colleagues in 1990 on wild cattle in Laos (used in the report on the Wild Cattle in this issue) is the only recent source of *reliable information*. Almost every IUCN/SSC Action Plan emphasizes the need to carry out extensive surveys. One cannot conserve something about which one does not know anything.

In a paper entitled, "**Conservation: A Consideration of Evolution, Population, and Life History**", John Eisenberg and Larry Harris (1989) point out, "Clearly, what we need to retard the events that could transpire by the year 2100 is information on the status of vertebrate species and a monitoring system to give us an indication when a species appears to be in trouble (Humphrey 1985). Only if we know there is a problem can we attempt a solution. The solution we effect will be dependent on how much we know about the species biology. Environmental monitoring and single-species studies can help us divert problems before they become critical; however, this is a labour-intensive, extremely expensive solution. The least expensive solution is to manage at the ecosystem level, thereby attempting to preserve through time the entire assemblage of species. Ultimately, this requires the maintenance of very large tracts of land, especially if one considers the top carnivores to be essential components of the ecosystem and worthy of maintenance.

Some arm-chair critics may like to pooh-pooh surveys, public education programmes, and other such old fashioned recommendations as protection of habitat as a firm basis for the conservation of wildlife, but these have worked in the past and so can be relied upon to do so even in the future. Technology can only offer a false hope for salvation. What about the costs involved? Can economically poor countries like Laos, Cambodia and Vietnam afford high-tech conservation strategies? It would cost on the order of US$ 50,000,000 per annum to sustain 200 primates species alone. In contrast, it costs only 500,000 dollars to conserve thousands of animals and plants in the 15,000 km2 Serengeti National Park (Western 1986).

Any long-term conservation programme, be it designed for a bustard or a buffalo must be planned on the basis of a logical progression through a series of phases, involving the processes of discovery, assessment and prediction (Sale 1985). The initial "discovery" phase would require surveys. To recommend that we by pass this basic phase and go to a predictive phase would be a recipe for disaster. Some countries in Asia are still in the early "discovery" phase and as far as the wild cattle are concerned, there is still a paramount need for extensive surveys to be carried out in Laos and Cambodia.

Forests still cover three and a half times as much of the earth's surface as cropland. But they are shrinking at an accelerating pace. The

earth has lost almost one fifth of its forest since pre-industrial times. The great tropical rain forests have been so far the least affected. Until recently they were so inaccessible and sparsely populated that they were relatively safe. But not anymore. Today, the tropical forests are coming under increasing threat from the devlopment agencies and are being mined and torched. It is a common misconception that tropical countries are necessarily fertile, and all that is required for the production of fine crops is the introduction of modern machinery and mass production methods. This belief led for example, to the ground-nut disaster in Tanzania (Ashby 1967). Nevertheless, Governments still assume that fragile forest lands can be easily cleared and farmed. Even such august body as the World Bank fell into this trap. In 1960s and 1970s, the World Bank took the view that it would be profitable to clear large areas of unexploited land for development. The Bank is wiser now but not before it became involved in the now abandoned plan to move a million people from over crowded Java to the forested outer islands of Indonesia (The Economist 1989).

Merely setting aside conservation areas in a country is not enough. Many of the parks in the Third World are "paper parks". The western attitude to consumption too must change. On the one hand, people are encouraged to have more and more consumer goods and on the other, they are asked to preserve natural resources. Both are incompatible. To cut down wants and live in harmony with nature will be rational. Mahatma Gandhi expressed these thoughts and he was killed. The problem, as Mishra (1985) points out is how to establish a less arrogant, and more humane society which would not look at nature as something outside but a part of being.

Without surveys, we cannot assess the status of the species. Those of us who advocate the old fashioned surveys and habitat protection may be laughed at by some pundits as being out of step with modern thinking, but as Eisenberg & Harris (1989) argue, "We may be classified at the moment as hopeless romantics, but from our perspective, a lifetime of dedication to conservation cannot be dismissed by trivial criticisms.

Charles Santiapillai

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Status, Distribution and Conservation of Wild Cattle in Laos

by

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1.0 Laos: an overview

Separated by the Mekong river from Thailand and isolated from Vietnam by the rugged Annamite Mountains, the land locked country of Lao People's Democratic Republic stretches along a distance of 1,150 km between latitudes 14°N and 22°N. It is bounded to the north by the People's Republic of China, to the east and northeast by Vietnam, to the south by Cambodia, and to the west and northwest by Thailand and Burma respectively (Fig. 1). With a total area of 236,800 km2, Laos is about the size of Great Britain.

Laos is largely mountainous. A number of forest-clad mountains dominate the landscape. The mountains in the north reach a maximum of 2,819 m. The general tilt of the land is upwards to the east towards the Annamite range in Vietnam. Hence virtually almost all the rivers in Laos drain into the Mekong and a few that are on the east flow through Vietnam towards the South China Sea. The Mekong flows through Laos from Yunnan province in China in a southerly direction, forming much of the boundary of Laos with Thailand. The rainy season is from May to October during which the country receives about 2,300 mm of rain annually.

The vegetaion of Laos was originally evergreen and semi-evergreen forest. About 47% of the land (or 11,273,000 ha) is under some form of forest cover including degraded forests (Salter 1989). Grassland cover an area of 333,000 ha. Land under permanent cultivation is estimated to be between 4 and 6% of the total land area.

With a human population that numbers about 3,618,000 (White 1987), Laos represents the most sparsely populated country in Southeast Asia. The average population density of 16 per km2 is the lowest in the region. To build the population up, the Government in 1976 prohibited the sale of contraceptives. Laos nevertheless is a land of many tribes. There are four basic linguistic-political groups: 1. Lao-Lu or valley Lao, 2. Lao-Tai or tribal Lao, 3. Lao-Theng or Mon-Khmer, and 4. Lao-Soung which include the Miao and Yiao. In all, there are 68 ethnic groups (White 1987). Over 50% of the population lives in the fertile alluvial plains of the Mekong river, which accounts for only 11% of the total land area. The hill tribes whose traditional slash and burn agricultural practices prevent them from establishing permanent settlements. Ninety percent of the people are engaged in wet rice cultivation. A major agricultural produce is opium, grown mainly by the Miao tribes and traded illegally.

2.0 Current Status of Wild Cattle

Probably four species of Wild cattle are still extant in Laos (Sayer 1983a). These are the asiatic wild water buffalo *(Bubalus bubalis)*, banteng *(Bos javanicus)*, gaur *(Bos gaurus)* and kouprey *(Bos sauveli)*. Of these it is the gaur that appears to have the widest geographical distribution, occurring in forested areas throughout the country. A survey carried out in 1989 of the southern part of Laos indicated that the gaur is sympatric with the other three species of wild cattle. It has been reported present in numerous areas by villagers (Salter *et al.*, 1990). Although typically a forest animal, the gaur is also known to prefer more open habitat that man creates within the dense forests through his slash and burn agricultural practices. Accord-

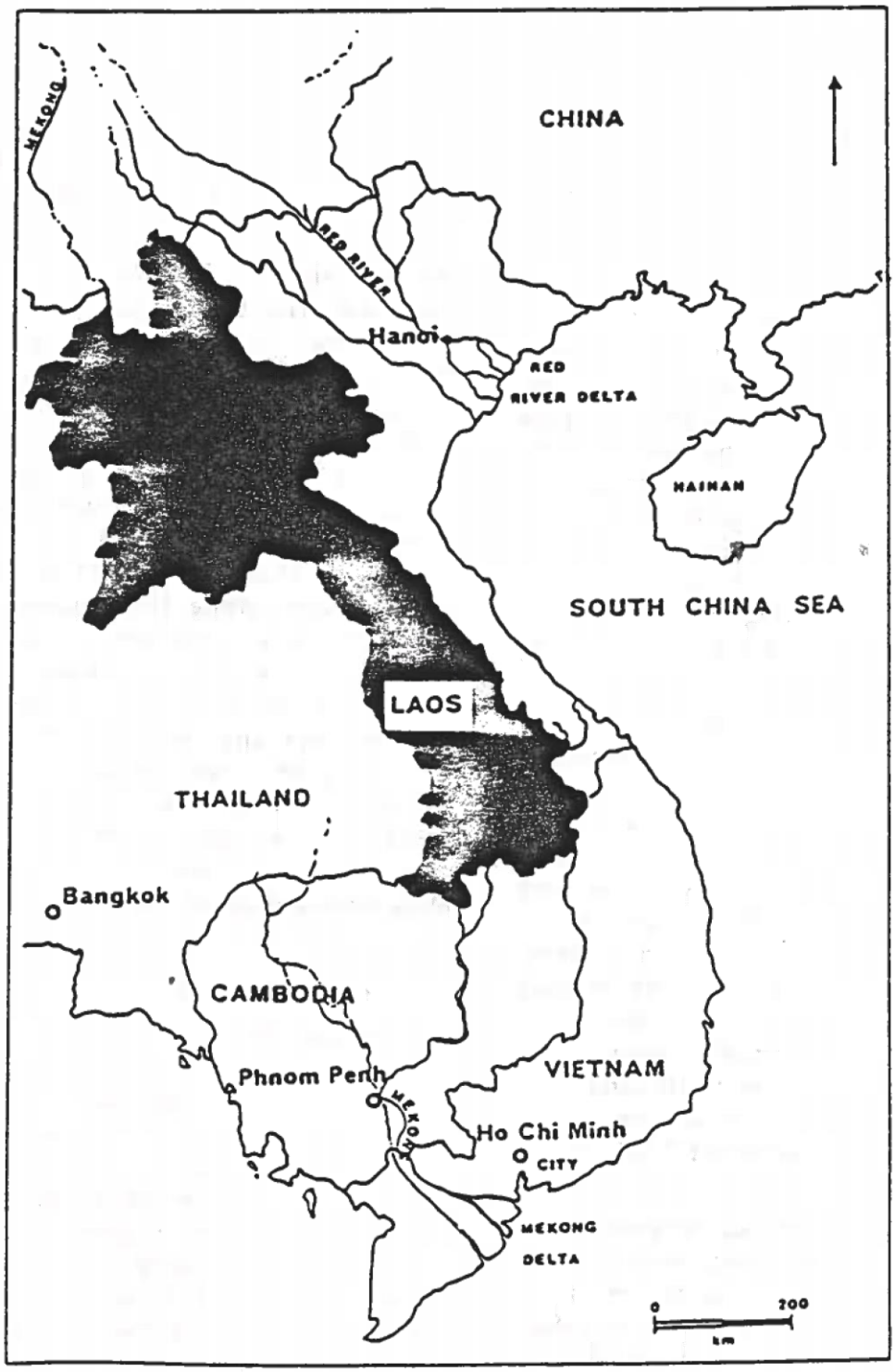


Fig. 1 Map of Indo-china indicating the location of Laos (shaded black) in relation to other countries.

ing to Hubback (1937), the light colour of the young is an indication that the animals are adapted to a more open environment. It is listed as Vulnerable by IUCN (1988).

The banteng *(Bos javanicus)* although numerous was never widespread in Laos (Sayer 1983a). Unlike the gaur, the banteng is more associated with open areas than dense forests. In the past the animal was known to have ocurred in large numbers in the north in the Luang Prabang range, the Khammouane plateau and south of Samneua and along the border between Laos and Cambodia (Thornback 1984). However, in many of these areas, numbers have declined largely due to forest clearance for agriculture and forest destruction by relentless bombing and the use of defoliants during the Indo-china war. Hunting for meat and trophy is another factor for the local decline in numbers. The species is listed as being Vulnerable by IUCN (1988).

The kouprey *(Bos sauveli)* is one of the most seriously endangered species of large mammals in the world. It is listed in the Appendix I of the CITES. In Laos, it is the country's only protected species (Hedges 1990). The total population in Laos is estimated to be between 40 and 100 animals in the dense forests along the border with Cambodia (MacKinnon and Stuart, 1989). A more recent survey carried out in Laos by Salter *et al.* (1990) was able to identify many areas between 14 and 16 N latitudes where the kouprey is still known to occur. The kouprey suffered heavy losses during the Indo-chinese war and from hunting pressure in the recent past. IUCN (1988) lists the species as Endangered.

The water buffalo *(Bubalus bubalis)* is an endangered species (IUCN 1988). It is widely reported from the extensive lowlands in the southern part of Laos. However, Salter *et. al.*, (1990) do not rule out the possibility that many of the sightings by people may in fact refer to only feral buffalo. Water buffalo are associated with the grasslands on the alluvial flood plains. However it is in this region, much of the forest clearance had taken place to make way for human settlement and permanent agriculture. Therefore the water buffalo may have disappeared from much of the land and is one of the most seriously endangered species in Laos besides the kouprey.

3.0 Conservation Measures Taken

Until recently, Laos was one of the few Asian countries that had not allocated areas for conservation of nature (Sayer 1984). What protective legislation there was, dates from the

Table 1. Proposed system of National Parks and Wildlife Sanctuaries in Laos (Source: Sayer 1983a)

	Province	Name of Reserve	Area (km2)
1	Champassak	Dong Khan Thung	180
2	Champassak	Xe Piane	1,240
3	Attapeau/Sekong	Xe Khaman	1,162
4	Savannakhet	Phou Sanhe	659
5	Khammouane	Plateau Nakay	476
6	Bolikhamsai	Nam Chuan	892
7	Vientiane	Phou Khao Khouay	500
8	Sayaboury	Nam Poui	678
9	Louang Namtha	Nam Ma	399
10	Phongsaly	Phou Dene Dinh	1,147
	Total		7,333

French Colonial period under whose administration there were some efforts to restrict hunting and protect some of the most endangered species. In 1939 the whole of the southern and central Laos was declared a hunting reserve (Sayer 1983a). Today several areas rich in biodiversity (Table 1) have been identified for inclusion in the system of protected areas (McNeely 1975, Sayer 1983a).

To these must be added some more proposed protected areas which may be significant as far as the wild cattle species are concerned. They are: Phou Ilang, Vat Phou, Dong Hua Sao, Tha Teng, Dong Amphan, Bolovens Plateau, Nam Kong, Dong Kalo, Phou Done Khong, Dong Khok Pa Dek and Dong Khan Thung (Salter *et. al.*, 1990). Of these areas, only Xe Piane has been surveyed and is likely to be included in the protected area system under development (Salter *et. al.*, 1990).

About 68 areas in all have been proposed for inclusion in the system of protected areas and they represent 20% of the land area of Laos (Salter 1989). But only 60% of these areas are representative of undisturbed forest. (Fig. 2).

The Government of Laos has enlisted the cooperation of SIDA and IUCN to carry out extensive field surveys throughout the country in an effort to identify key conservation areas for protection and management. The Government intends to manage 5,000,000 ha as Production Forest, 9,500,000 ha as Protection Forest and 2,500,000 ha as Conservation Areas (Salter 1989).

One of the most serious causes of conservation problems in Laos is uncontrolled logging. This has been further exacerbated by the total ban on logging within Thailand imposed by the Thai Government in 1988. Logging companies in Thailand are known to have moved their operations into neighbouring Laos and Burma. Between 1975 and 1987, before the Thai logging ban was imposed, the rate of extraction of timber in Laos was 200,000 cu. m per year. This increased to 334,000 cu. m in 1988. The Government in Laos, mindful of the consequences of indiscriminate logging, adopts the selective method of timber extraction. In March 1989, the Lao Government placed a ban on the export of timber as it recognised the serious consequences of rapid deforestation (Phiathep 1989).

The Phou Khao Khouay protected area has been developed as a National Park in Vientiane Province. This area is known to have a population of gaur (Phiathep 1989). In addition to gaur, this park also supports populations of other endangered species such as the asian elephant and the tiger. Other bovid species such as banteng and water buffalo may occur as well. But it is also known that in addition to the slash and burn agriculture practiced within the park by some indigenous tribes, the army personnel also appear to have taken a more than casual interest in agriculture (Devitt and Sayer 1984).

Laos created two offices in 1983, the Office National de la Protection de l'Environment (ONPE) and Office National de Chasse et Peche (ONCP) with the mandate to oversee the various aspects of nature conservation (Sayer 1983b).

4.0 Conservation Measures Proposed

Laos is relatively a large country endowed with vast natural resources but a small human population majority of whom live in the lowlands and in the valley of the Mekong river. A major challenge facing wildlife conservation in Laos is the development of a system of secure protected areas that can count on the support of the people. Many of the indigenous tribes have no other means of livelihood than carry out slash and burn agriculture and rely on bush meat for protein. The development of protected areas is unlikely to succeed if it fails to take into account the traditional rights of the local communities.

The most important conservation recommendation is therefore for the establishment of a series of protected areas that are large enough to accommodate within their boundaries samples of the diverse ecosystems and biological richness of the species. As a start, this could be achieved in a system comprising 7–10 protected areas (Sayer 1983b). The following is a partial list of areas that deserve total protection (Anon 1976): –

1. Phou Khao Khouay – developed as a National Park. It has an area of 130,680 ha

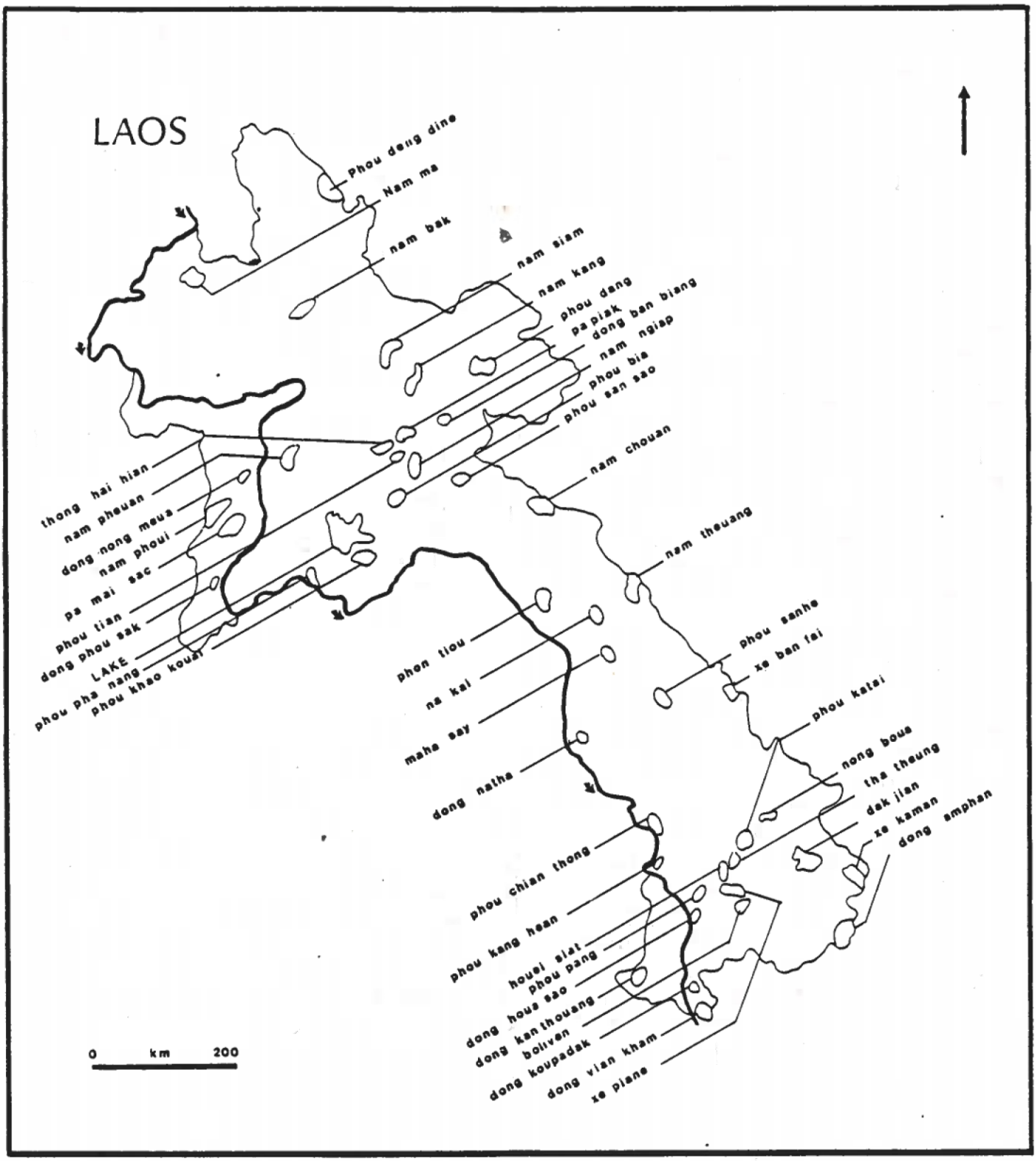


Fig. 2 The Network of the proposed protected areas in Laos (Source: Ministry of Forestry, Laos 1990)

and has an altitudinal range from 200 to 2000 m.

2. Hodari Sou – a part of the natural area shared with Cambodia and Vietnam.

3. Bolovens Plateau – an important watershed with large tracts of rain forest that are unfortunately dotted with clearings (McNeely, pers. comm.). This area could regain its importance vis-a-vis wild cattle conservation, if the area can be cleared of people and kept as a strict nature reserve (McNeely, pers. comm.).

Another important conservation area that should be developed as a wildlife sanctuary is the Nakhan Plateau in the Khammouane province known to harbour not only wild cattle but populations of elephant and tiger as well. This area is especially known for its population of guar.

The most immediate requirement for improving the country's conservation programmes is international aid to the Ministry of Forestry to strength its manpower and make available both the expertise and money to carry out intensive field surveyes to identify viable populations of wild cattle and establish appropriate reserves for their long term survival. It is also essential that Government policies that lead to inappropriate use of the species and their habitats must be changed and this McNeely (pers, comm.) considers as the highest priority.

As Kingdon (1988) argues, an informed populace is an essential cornerstone of successful conservation. Much effort must be placed on educating the public on the long-term harmful effects of habitat degradation and of the need to protect samples of natural ecosystems. Conservation education must be incorporated into the school curriculum. Much of the effort must be spent on informing the public of the endangered status of the wild cattle in Laos and thereby deter the hunting and trade in these species.

Wherever possible, "transfrontier reserves" must be established to protect seasonally migrating species such as the Kouprey along the borders with Cambodia and Vietnam. These reserves could then be managed cooperatively by the three countries concerned and such cooperative measures are also needed to prevent cross-border trade in wild cattle products (Salter *et al.*, 1990).

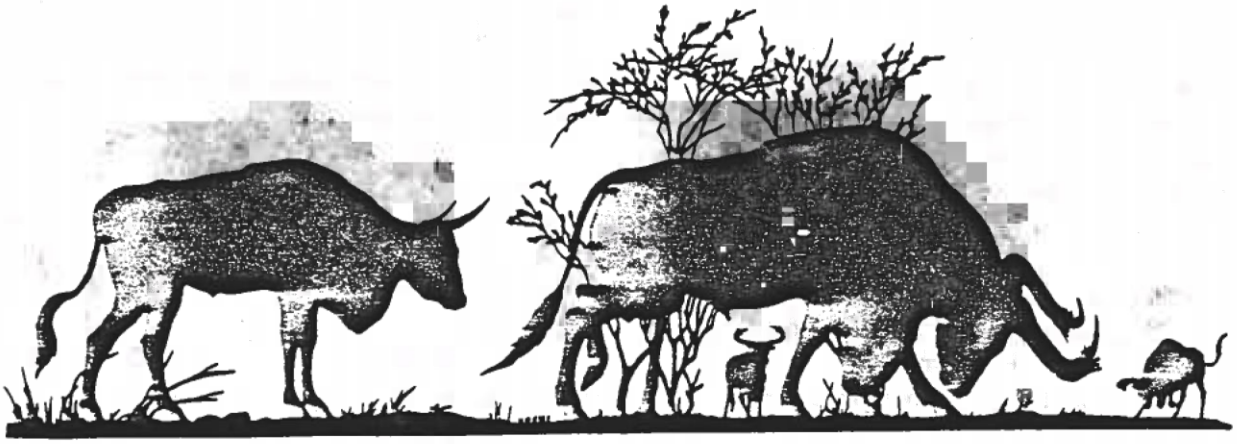
5.0 Species Accounts

This section summarises information on the distribution, abundance and conservation of each of the wild cattle species in Lao P.D.R. Detailed information on each species is sketchy as very little work has been done to date.

5.1 Kouprey *(Bos sauveli)*

5.1.1 *Distribution & Population:* Historical range of the Kouprey might have extended as far as southern China (Hoffmann 1986). Today however, the animal is confined to the Indochinese peninsula (MacKinnon and Stuart 1989). In Laos, there had been reports of Kouprey being sighted in the forested areas of Attapeu and Champassak areas, and in the areas southwest of Kompong Sra Lau (Sayer 1983a). Neese (1976) recorded the occurrence of the kouprey from southern Laos based on hunter's reports but even then the animal was considered to be extremely rare (Thornback 1984). More recent surveys carried out by Salter *et al.* (1990) have identified seven areas in the southern part of Laos, in the lowland forests that extend from the Thai border in the west to the Annamite Range of mountains to the east and down south to include most of Cambodia (Fig. 3a). Just two or three decades ago, the kouprey was known from a number of areas north of the 15 latitude. More intensive surveys are likely to identify even more areas where the elusive kouprey might still survive. Laos is estimated to have a population of between 40 and 100 animals (MacKinnon and Stuart 1989) but judging from the wide distribution of the recent sightings this estimate could be even conservative (Salter *et al.* 1990). Numbers are probably on the decline because of loss of habitat to agriculture and to poaching.

5.1.2 *Habitat, Food & Reproduction:* Like the banteng, the kouprey inhabits open areas such as savannas, woodland meadows and scattered glades in the monsoon forests (National Research Council 1983). The animals need both open areas to forage and dense forests to retreat



into to escape from predators and the scorching heat in the summer (Wharton 1957). In addition water holes and salt licks are essential to provide year long water and vital minerals. Its diet is mixed it being a browser as well as grazer. Daily food consists of a mixture of bamboo grass (*Arundinaria* spp.), ploong grass *(Arundinella setosa)* and koom grass (*Chloris* spp.), sedges and some browse (MacKinnon and Stuart 1989). Kouprey habitat is to a great extent dependent on the slash and burn agriculture (Wharton 1957). Breeding may coincide with the onset of the dry season in April. Young are born after a gestation period of about 8 to 9 months during the cool period from December to February when there is plenty of fodder available. Cows are known to leave the herd before parturition and return with their calves after about a month (National Research Council 1983).

5.1.3 *Status:* The kouprey is one of the rarest surviving large mammals in the world. Although IUCN (1988) lists it as being Endangered, in Laos, it is a protected animal awaiting the ratification of a new game protection law (MacKinnon and Stuart 1989). Unless strong conservation measures are adopted to secure the kouprey's habitat, the animal may soon become extinct in Laos.

5.1.4 *Conservation Measures Proposed:* Given the fact that the survival of the kouprey is intimately linked to the availability of many large, diverse, well-managed and secure habitats, the primary concern must be in establishing a network of protected areas that could assure the long-term survival of not only the kouprey but other key endangered species as well.

In the case of the animals that are categorised as "doomed", then every effort must be made to capture and re-locate them into already secure reserves if such an action is feasible. It is only when these protection of the habitat and the re-location of doomed animals into secure habitat are not possible should the animals be sent to the zoos for breeding in captivity. Not all small populations are necessarily doomed and therefore all efforts must be focussed on protecting their habitats and reducing the poaching pressure. To do so, international assistance in the form of money, material and manpower would be needed in Laos.

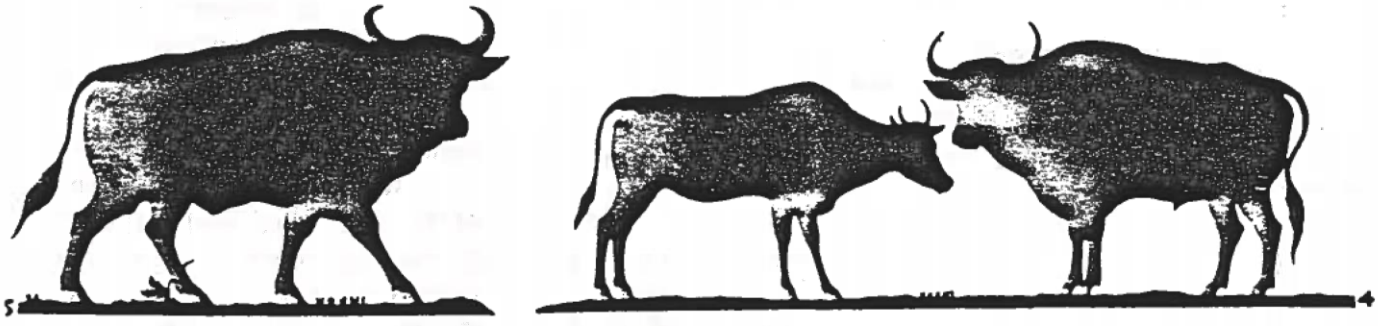
The management of kouprey within protected areas need not come into conflict with slash and burn agricultural practices of the indigenous people if such practices were to be carefully controlled and confined to the periphery of the reserves in the so called buffer-zones. Within reserves, core areas need to be identified. Strict protection and effective management will be necessary within these core areas while, fire management would be necessary outside the core areas with the view to enhancing the habitat for the kouprey and other wild cattle. In the long run, all endangered species of wildlife are likely to survive only within theh confines of the strictly protected reserves (Parker 1984, Spinage 1986).

5.2 Banteng *(Bos javanicus)*

5.2.1 *Distribution & Population:* Unlike the Gaur, the banteng was never widespread in Laos (Sayer 1983a). Small populations still occur in substantial areas in the south (Fig. 3b) between latitudes 14 and 16 close to the Thai, Cambodia and Vietnamese borders with Laos (Salter *et al.*, 1990). The only record of Banteng from the north of this area comes from Brix and Deuve (1963) who recorded one animal being shot at Pakcading in 1962.

Given the distribution of this species in neighbouring Thailand, Sayer (1983a) speculates that it might occur in Sayabouri province as well. There is no information currently available on the population size of banteng in Laos. Banteng however is known to live in small groups of up to 8 animals (Halder 1973).

5.2.2 *Habitat, Food and Reproduction:* Banteng is closely associated with the deciduous monsoon forest where it prefers to inhabit flat or undulating terrain (National Research Council 1983). They are shy animals that avoid large human settlements as well as plantations. Banteng are mixed feeders on both browse and herbage (Hedges 1990). They prefer to feed on grass but are known to utilize herbs, leaves, fruits, and young bamboo as well (National Research Council 1983). Period of rut may coincide with the duration of the rainy season from June to September. Calves are born after a gestation period of 9—10 months. Male mortality is high in comparison to that of the females.



5.2.3 *Status:* Although IUCN (1988) lists banteng as being vulnerable, it is best regarded as one of the endangered species in Laos. Very little is known about the status of the species north of 16 N latitude.

5.2.4 *Conservation Measures Proposed:* Development and implementation of effective management plans for the wildlife reserves that have been identified in Laos, especially the Xe Piane reserve in Champassak province which might harbour all four species of wild cattle. These management plans for the reserves should clearly outline a programme for establishing secure boundaries, enforcing protection regulations, monitoring the biological resources and human impacts, developing any other aspects that are required e.g. research facilities, social assistance to local communities and nanture oriented tourism.

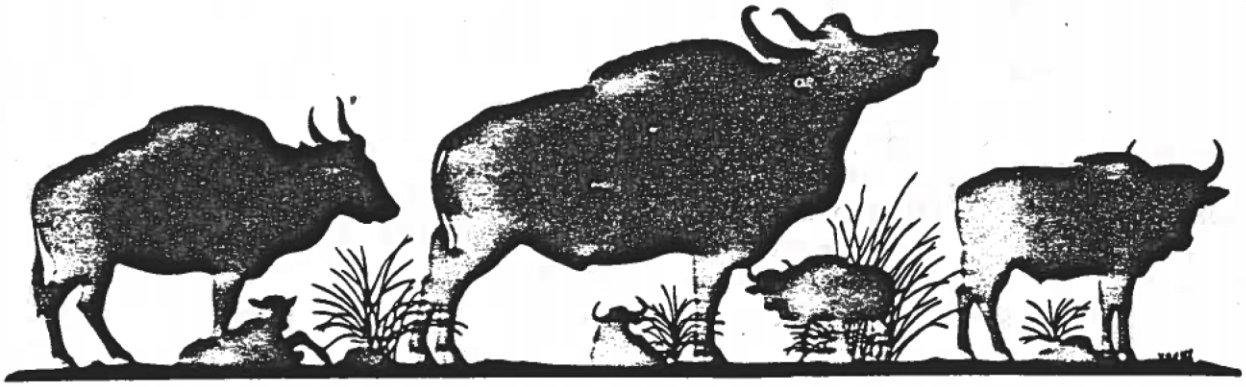
Vast areas in Laos are in need of intensive surveys to identify viable populations of banteng and other wild cattle. Once these surveys identify doomed animals, they could be captured and relocated to more secure reserves where the level of protection is high enough to ensure the animals' continued survival. But such translocations are extremnely expensive and so should not be regarded as a high priority.

Conservation education must be carried out both in schools and villages to increase the people's awareness of the value of their rich wildlife heritage. Given the fact that a large proportion of the people of Laos is Bhuddhist, it should be possible to instil in their minds the value of protecting wildlife. It should not be too difficult in a country where the Buddhist population already known to exercise restraint on killing any animals during the rainy season when most of the animals are breeding (MacKinnon and MacKinnon 1986).

5.3 Gaur *(Bos qaurus)*

5.3.1 *Distribution & Population:* Of the four species of wild cattle in Laos, the gaur is the most widely distributed. It is typically a forest species that thrives well in a mixture of dense forest areas interspersed with more open glades (Schaller 1967). The field surveys carried out by Salter· *et al* (1990) indicate that guar still occurs in the vicinity of 94 out of 104 villages in the southern part of Laos bordering Thailand and Cambodia (Fig. 3c). More surveys carried out throughout the country will certainly extend the known range of gaur and other wild cattle species in Laos. Historically, the largest concentrations appear to have co-existed with shifting cultivators (National Research Council 1983). There is no information on the size of the gaur population in Laos.

5.3.2 *Status:* IUCN (1988) lists it as being vulnerable but populations that are not protected within the conservation areas are in danger of extinction (National Research Council 1983). Throughout its range in Asia, the gaur has been hunted for its meat, exposed to diseases of domestic cattle and displaced from its natural habitat by human encroachment and Laos is no exception.



5.3.3 *Habitat, Food & Reproduction:* Although a forest species, the gaur can adjust to disturbed land and also adapt to man's presence if not unduly harassed (National Research Council 1983). Gaur is known to inhabit both mountainous as well as lowland forests especially those where there is a mosaic of vegetation types. Riparian forests are another habitat preferred by gaur (Weigum 1972). Gaur are both grazers and browsers and prefer to feed on young green grass, leaves, twigs and even bark. The animals are known to travel long distances in search of suitable food plants. In Laos, bamboo may form a significant component of the animal's diet. Breeding does not appear to be seasonal. Calves are born at any time throughout the year after a gestation period of 270 days (National Research Council 1983).

5.3.4 *Conservation Measures Proposed:* The basic and fundamental conservation measure needed is the improvement of the degree of protection currently given to the conservation areas where wild cattle species occur. Efforts must be continued to strengthen the infrastructure and essential services of the national parks and other protected areas in Laos and to eradicate poaching.

If the protected areas are to be effectively protected, they have to be manned by personnel who are adequately trained. International assistance should be channeled into providing regular training programmes for guards.

There is still an overwhelming need to carry out field surveys in most of the provinces in Laos. Such surveys would not only help understand the current status of the wild cattle species but also identify the so called "doomed" populations or individuals that need to be captured and relocated into secure reserves to enhance their survival.

Given the fact that gaur have little immunity to the diseases of domestic cattle, it would be in the interest of the wild cattle if the domestic

cattle are innoculated periodically especially in areas of human settlements adjoining wildlife reserves.

The gaur is well adapted to respond to a "sanctuary strategy". Gaur herds can be increased in number in forest reserves for re-populating areas where they had become extirpated recently.

5.4 Wild water buffalo *(Bubalus bubalis)*

5.4.1 *Distribution & Population:* Once widely distributed in Laos, the endangered species of wild water buffalo is now restricted to few small populations surviving in inaccessible regions beyond the reach of man. In a survey carried out by Salter *et al.* (1990) they found evidence for wild water buffalo in only 24 localities out of a total of 94 that were investigated. All the recent records of water buffalo were scored in the southern part of Laos bordering Thailand and Cambodia between 14 and 15 latitudes (Fig. 3d). There is also evidence for the presence of wild water buffalo in central Laos from Khammouane province on the basis of a convincing report given by a forester (Sayer 1983a). However, today this area appears to lack the animal's preferred habitat, namely the marshy floodplains (Sayer 1983a). No data are available on the size of the population of buffalo in Laos. Given the paucity of the records of sightings, the population is likely to remain very small and therefore highly endangered.

5.4.2 *Status:* The species is highly endangered in the wild and will become extinct unless drastic, rapid action is taken (Thornback 1984). Many of the wild populations may be interbred extensively with free ranging domestic buffalo that they may no longer be considered truly wild.

5.4.3 *Habitat, Food & Reproduction:* In Laos, the water buffalo is closely associated with marshy riverine habitats especially the floodplains. Although primarily a grazer, the buffalo spends a lot of time within the forests to browse on tender leaves and fruits. But its chief haunts are water holes where it is often seen to wallow. Buffalo are unselective in their diet, eating nearly everything that they encounter on their movement (Hedges 1990). The proportion of browse in their diet increases during the dry season and may be important for subdominant bulls who are excluded from better quality habitats by high ranking bulls (Ashby and Santiapillai 1983, 1986). Breeding season is influenced by climatic factors. Gestation period is 10 months.

5.4.4 *Conservation Measures Proposed:* As in the case of every endangered species of large mammal in Laos, the primary focus must now lie in the identification of key viable populations of wild water buffalo. This can be brought about only by carrying out extensive surveys throughout the country by a number of field biologists and wildlife managers. Laos is still virtually an unexplored country and so extensive surveys will determine the distribution, number and status of not only wild cattle but other important species of animals as well.

Once the surveys are completed, legislation must be enacted to safeguard the key conservation areas where the wild water buffalo occurs. Core areas have to be demarcated within these conservation areas where no form of human activity can be permitted. Core areas must essentially protect the areas where the buffalo breed.

In areas where human settlements and wildlife reserves co-exist, care must be taken to mini-

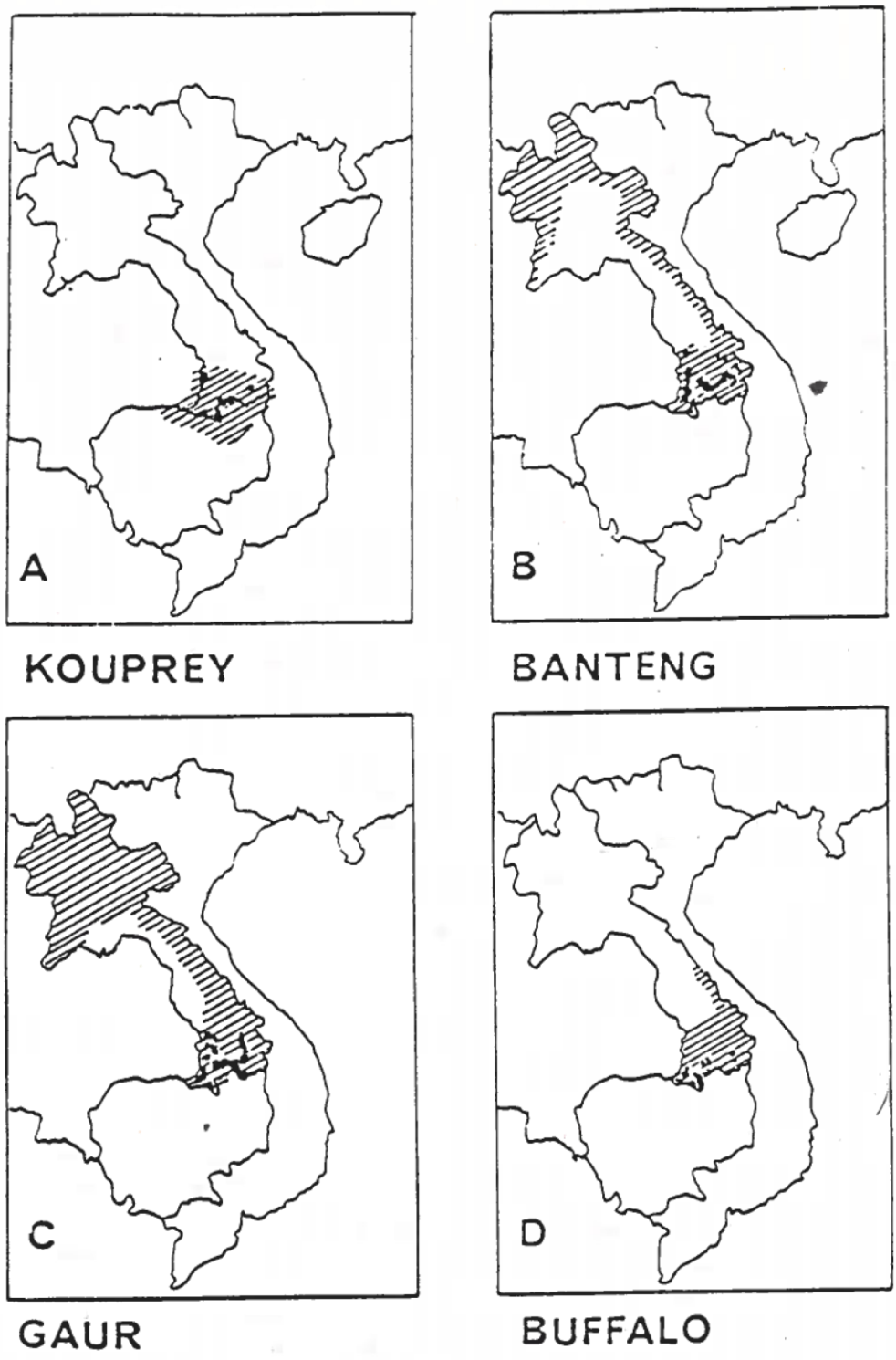


Fig. 3 Current distribution of the four species of Wild Cattle in Laos (A) Kouprey, (B) Banteng, (C) Gaur and (D) Buffalo

Solid areas where there is positive evidence of presence. Cross hatching represents the extent of additional suitable habitat but where positive evidence is lacking.

mise the mixing of the domestic cattle with the wild ones. Such amove would greatly reduce the genetic risks of too much interbreeding and thus ensure the genetic integrity of the wild populations.

There are other aspects of interactions between the wild and domestic cattle: they share common diseases which are particularly lethal in respect of breeding success of the wild cattle, including haemorrhagic septicaemia, brucellosis and foot and mouth disease which are major killers of bovids in peasant agriculture (Ashby and Santiapillai 1987). Wherever domestic livestock are present near wild cattle areas, they must be vaccinated against endemic diseases so as to form an immune barrier against infection (MacKinnon and Stuart 1989).

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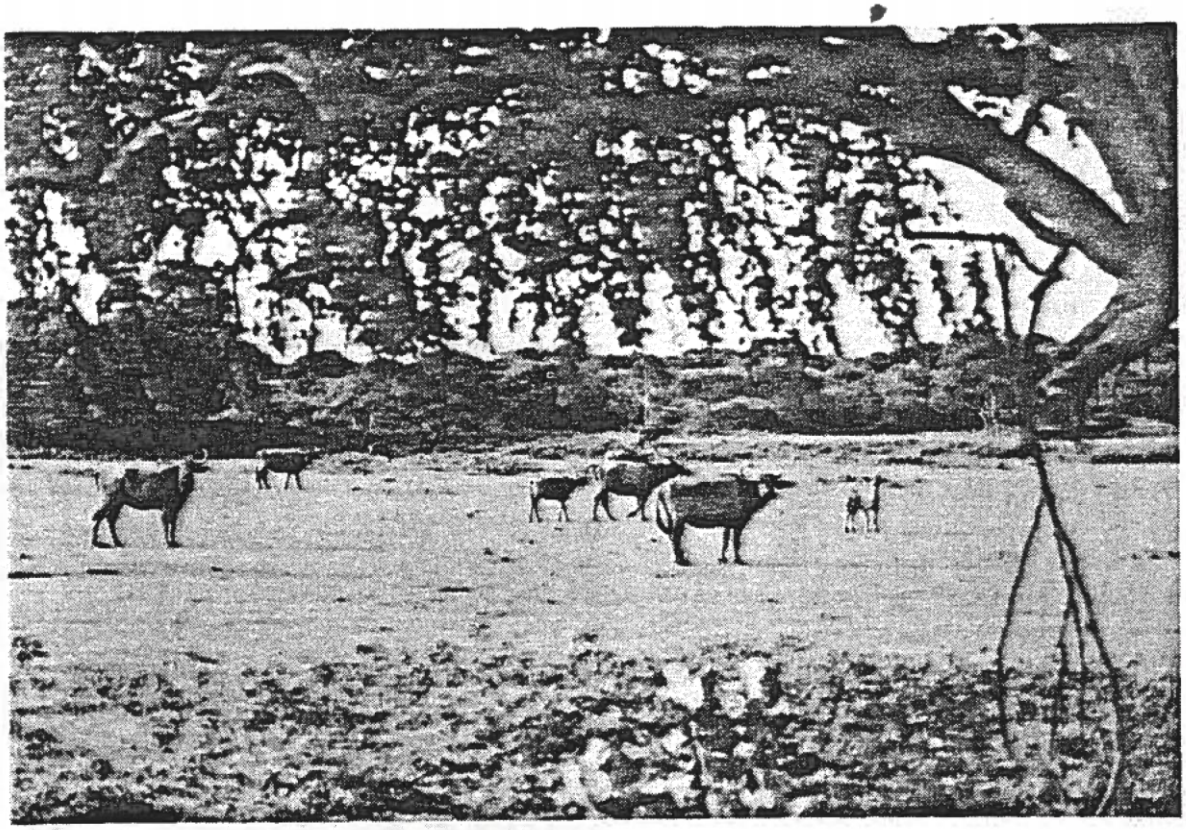

A herd of wild water buffaloes Ruhuna National Park in Sri Lanka. (Photo: Charles Santiapillai)

AN ASSESSMENT OF THE NUMBER OF WATER BUFFALOES *(Bubalus bubalis L.)* IN THE RUHUNA NATIONAL PARK, SRI LANKA

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1. *Introduction:*

The wild water buffalo *(Bubalus bubalis L.)* is one of the most conspicuous species of large mammals found within the network of protected areas in the low country dry zone in Sri Lanka, although at times some solitary bulls may wander up into the lower hills (Phillips 1984). It is also the largest member of the family Bovidae in Sri Lanka (Fig. 1) and the second largest bovid found in peninsular India being exceeded in size by the gaur *(Bos gaurus)* which was extinct in Sri Lanka during the Pleistocene (Deraniyagala 1958). Several authors (Gee 1964, Ellerman & Morrison-Scott 1966, Maia 1970) have accepted the interpretations of the ancient texts which conclude that the free-living water buffaloes of Sri Lanka were derived from domestic stock brought in from India. However, Deraniyagala (1953—55) concluded that they are a subspecies distinct from the Indian form, on the basis of differences in body size and horn shape.

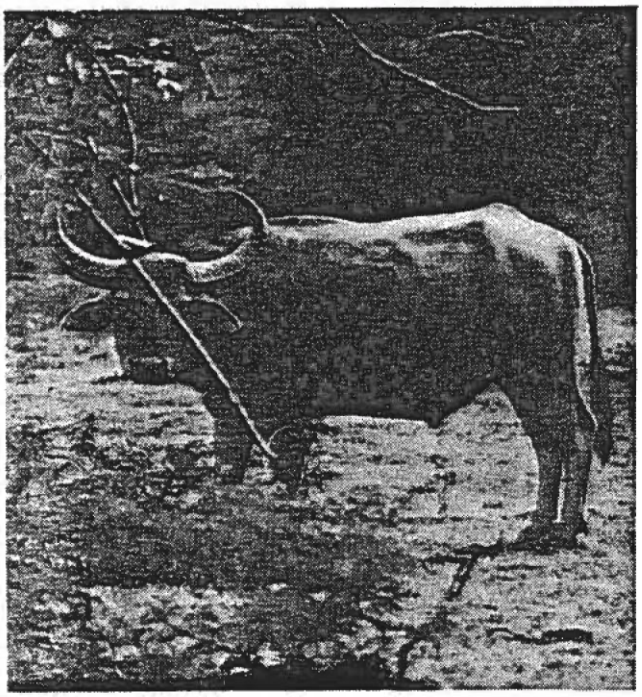


Fig. 1 An adult male buffalo in Block I of the Ruhuna Sri Lanka (Photo: Charles Santiapillai/WWF)

Even with regard to the domestic buffalo in Sri Lanka, there is a complex situation. It has the same chromosome number (50) as the river buffalo found in north India and Nepal, but it has the behavioural characteristics, particularly the intensity of wallowing, of the swamp buffalo which is native to south-east Asia and has a chromosome number of 48 (Ashby & Santiapillai 1983).

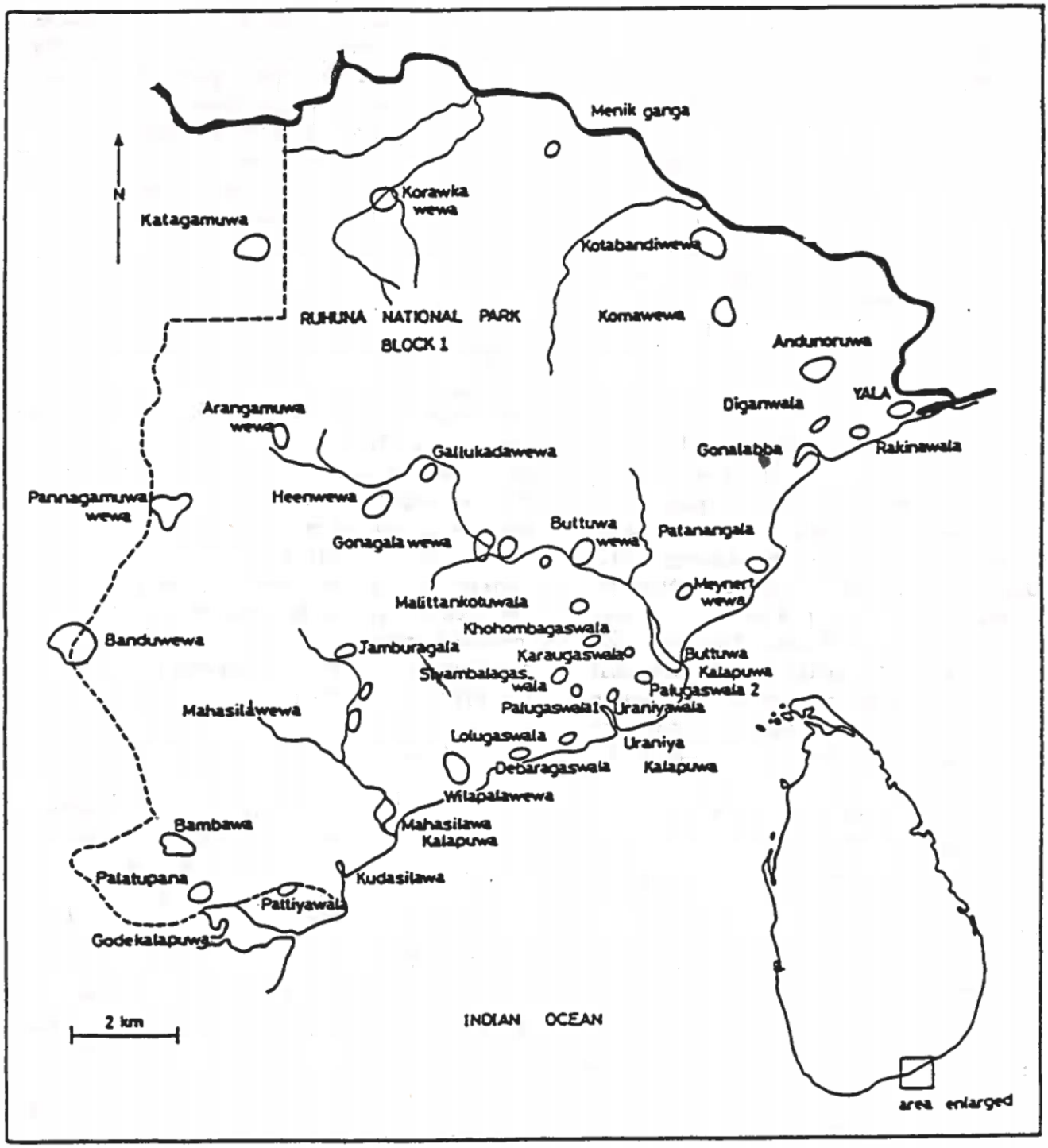


Fig. 2 Map of Block 1 of Ruhuna National Park, Sri Lanka showing the location of the main water holes. The nature and size of these is indicated by the terminal part of the name, wila – (pond or water hole), wala – pit (mostly now enlarged artificially but retaining ancient name), wewa – tank or reservoir (artificial lake), Kalapuwa – lagoon (in present stance, brackish lake separated from sea by a sand bar).

There has been for a long time a perception among many authorities involved in wildlife conservation in Sri Lanka, of the water buffalo particularly in the Ruhuna National Park being at the least over abundant and perhaps being a feral invader having no rightful place in its ecosystem (Ashby 1991). Such concerns can be traced to as far back as 1910 when the then Conservation of Forests reported on the growing scarcity of clean water sources in Ruhuna (= Yala) National Park and blamed the increasing population of feral water buffalo and pigs (Woodford 1979). In 1941, an official of the Wildlife Protection Society of Ceylon raised this issue again and estimated the buffalo population to exceed 3,000 head. In 1973, the Director of Wildlife Conservation reported to the Fauna and Flora Advisory Committee on the subject and in the same year, the Wildlife Protection Society of Ceylon estimated that the Buffalo population of Ruhuna National Park Blocks I, II and III had increased to over 10,000. By 1973, the Wildlife Protection Society of Ceylon (Sri Lanka) was claiming that overgrazing caused by the species was posing an imminent threat of disaster and that the population density of the species was in the order of 15 per km2 over much of the Park (de Silva 1973). Today, the Park remains a thriving ecological unit but there are nevertheless clear signs of unbalance with an apparently rapid spread of distatsteful, herbaceous species in this area of grassland near the coast where grazing by the species is most intense (Ashby & Santiapillai 1983). There are also the problem of diseases breaking out. Two years ago, swine fever almost decimated the population of wild pigs *(Sus scrofa cristatus)* in Block I of Ruhuna National Park (Mr B.V.R. Jayaratne, Deputy Park Warden, pers. comm.).

There had been a number of wildly exaggerated stories given credence in journals respected abroad suggesting that the buffalo was undergoing a population explosion (Ashby 1991). Subsequently however, preliminary studies carried out in Block I of the Ruhuna National Park (RNP) by Santiapillai and Chambers (1982) indicated provisionally that the number of water buffalo (and likewise of wild pig) was much lower than believed, and that the rate of breeding of buffalo was low. Outline counts by Santiapillai and Chambers in the late 1970's indicate that the published figures of high buffalo numbers were extrapolations from the most favoured habitats and perhaps exaggerate mean densities by a factor of ten. It is to re-assess the status of the wild water buffalo in RNP that the present survey was undertaken at the request of the Director of Wildlife Conservation, Dr Sarath W. Kotagama with the assistance of WWF-International.

The objective was not only to re-assess the status of the wild water buffalo and other large mammals in Block I of RNP, but more importantly train a group of wildlife staff to carry out regular monitoring of the status of the large mammals and thereby provide the park authorities reliable information relevant to the management of the megafauna. Sri Lankan wildlife authorities have long accepted the need for systematic research as a basis for improved management. This report discusses the findings of the survey carried out in Block I of RNP in June 1991.

2. *Study area:*

Ruhuna National Park (Fig. 2) is the second largest conservation area in Sri Lanka and is situated in the south-east in the low country dry zone. It comprises five blocks as well as the Strict Nature Reserve and the Yala East National Park (See Table 1).

The entire National Park bounded on the south and east by the sea, consists of forest and saline flats irregularly dotted with natural water holes and man made "tanks". Two rivers Menik Ganga and the Kumbukkan Oya, and a number of seasonal streams drain the area and discharge into the sea through a shifting system of sand dunes and brackish lagoons (Woodford 1979).

Block 1 where the study was carried out is roughly triangular in outline with the Menik Ganga forming the northern boundary separating Block I from Block II. The annual rainfall is about 1,000 mm of which the greatest (750 mm) falls in November, December and early

Table 1. Extent of the Blocks in Ruhuna National Park.

Ruhuna National Park	Blocks	Area (km2)
	Block I	140
	Block II	99
	Block III	408
	Block IV	265
	Block V	68
Yala East National Park	Block I	179
	Block II	3
Yala Strict Nature Reserve		289
Total		1,251

January (North-east monsoon) and the balance in April and May (South-west monsoon). The dry season extends from June to September.

3. *Vegetation:*

The coastal area in Block I is characterised by numerous water holes surrounded by grazing areas frequented by the water buffalo and other herbivores. The grazing grounds are dominated by the halophytic grass *Sporobolous tremulus.* These flats give way, on the landward side, to light jungle dominated by *Salvadora persica, Feronia limonia* and *Cassia fistula* (Woodford 1979). The vegetation of the Park has been classified by Mueller-Dombois (1968) as falling into three physiognomic categories:– (a) forest (with at least 20% of crown biomass above 5 m in height), (b) scrub (less than 20% of crown biomass above 5 m) and (c) grassland or plains (Fig. 3). The dominant tree species are *Manilkara hexandra, Drypetes sepiaria* in well drained soil and *Feronia limonia* (Balasubramaniam *et al.* 1980). In the scrub vegetation, some of the common shrubs and treelets are *Capparis sepiaria, C. zeylanica, Dichrostachys cinerea, Flueggea virosa, Randia dumentorum* and *Cretavia religiosa.* The main components of the grassy plains are *Eragrostris viscosa, Dactylotaenium aeqyptium, Sporobolous diandrus, Echinochloa colonum, Setaria pallidifusca* and *Alloteropsis cimicina* (Balasubramaniam *et al.* 1980).

4. *Methods:*

Given the fact that the water buffalo is site specific (Eisenberg & Lockhart 1972), we concentrated on counting all the animals at the specific water holes in the evening census while the morning census was carried out to identify the number of buffalo inhabiting the scrub forests. There is a movement of the buffalo from the forest into the open plains along the coast in the evenings and so a census carried out in the evenings in the latter area will give a reliable estimate of the minimum number of wild water buffalo in the park. The evening counts were always more than double the number scored in the morning census.

For census work, we distinguished four classes of buffalo based on the age criteria devised by Eisenberg & Lockhart (1972).

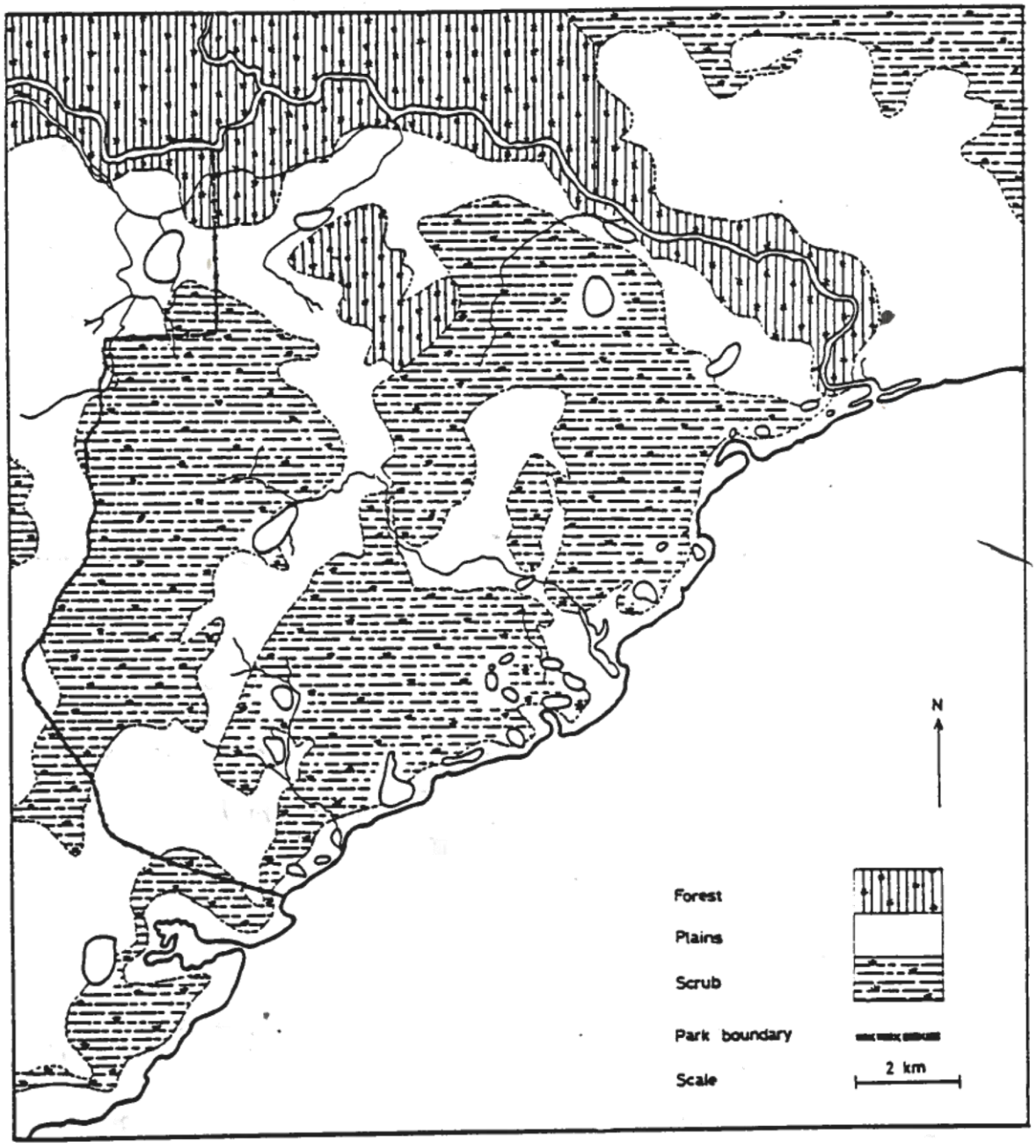


Fig. 3 Principal vegetation types and their approximate extent in Block I of Ruhuna National Park.

These were: adult, subadult, juvenile and calf. The calf can be easily distinguished by the absence of horns and its colour pattern (Fig. 4).

According to Eisenberg & Lockhart, horn growth begins at approximately six months of age when the animals are still considered juvenile class 1. In RNP, it is likely that horns may appear much earlier than six months. In the juveniles, the tan colour of the calf is replaced by a reddish brown coat. The horns are visible and are approximately 15 cm long. Males are considered subadult until the horn growth begins to show a pronounced curvature. The adult males have strong, stout horns (Fig. 1) that have a very thick base in contrast to those of the adult females which are thin and enormously curved (Fig. 5). These features are useful

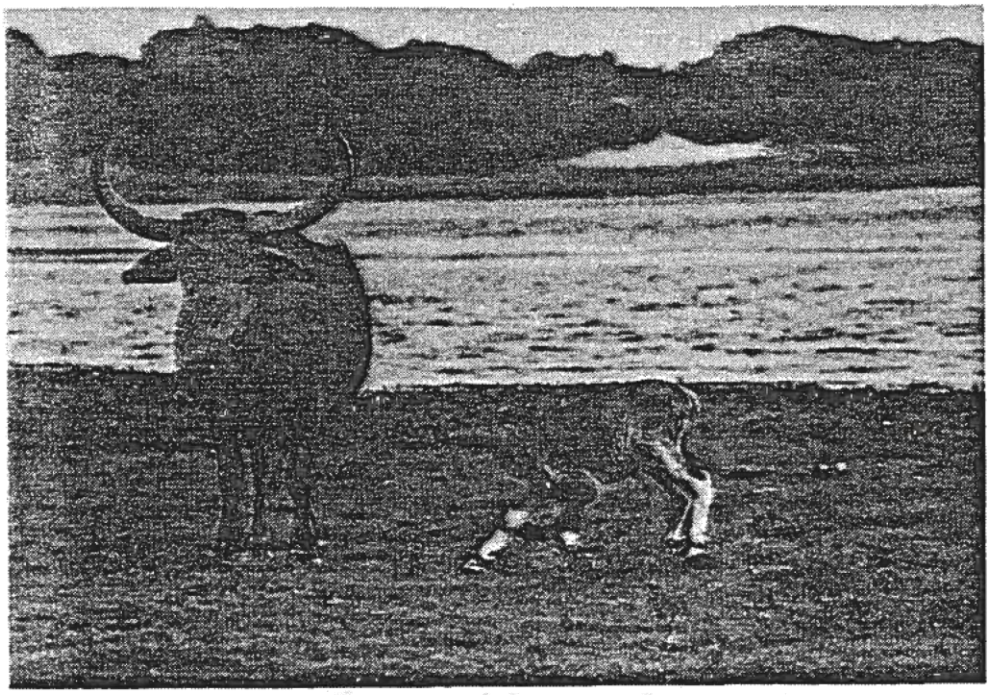


Fig. 4 An adult female water buffalo and her calf near the Wilapalawewa water hole in RNP. Note the absence of horns on the calf and its lighter coat colour. (Photo: Charles Santiapillai).

in sexing the animals when they are wallowing in water holes when it is impossible to observe the genitalia.

While the principal work was carried out in Block I, one morning census was also carried out in Block II to get an idea of the buffalo number in that area.

5. *Results:* A total of 2,526 water buffalo were counted in the study period, of which 700 were unclassified (Table 2). In Block II, a total of 291 animals were counted of which 215 were unclassified.

5.1 *Social Organization:*

Like many wild ruminants, the water buffalo tends to live in groups with mature bulls living apart from females and young for much of the year. The basis of the social organization is the herd.

5.1.1 *Frequency of Group Size:*

The frequency of group size of the water buffalo in Block I is shown in Fig. 6 and is based on a total of 273 groups (Table 3), while Fig. 7 illustrates the frequency of group size encountered in both Block I and Block II (302 groups in all). As can be seen in Fig. 6, solitary animals were sighted the most frequently and in over 90% of the cases, these were adult males (Eisenberg & Lockhart 1972, Santiapillai & Chambers 1982). The next most frequent group size was two individuals. Buffalo herd varies in size depending on the quantity and distribution of food and water, as well as physiographic, vegetational, and predatory factors (Miloszewski 1983). If we disregard solitary and paired animals and concentrate on the rest of the group sizes, it appears that there could well be two kinds of buffalo herds in Ruhuna: one characterised by smaller size of about 5 animals and the other much larger grouping consisting of more than 10 animals. These represent the forest buffalo and the villu buffalo herds respectively.

A buffalo herd's daily regimen depends first of all on the distribution of water throughout its habitat (Miloszewski 1983). As water is widely distributed throughout the herd's home range in Block I the need for regularly

Table 2. Population structure of Water buffalo in Block I of Ruhuna National Park

Period	location	Ad.m	Ad.fm	Subad.	Juvn.	Calf.	Total	??
17/6 pm	plains	14	105	23	30	00	172	37
18/6 am	forest	22	86	14	32	2	156	13
18/6 pm	plains	14	142	24	42	3	225	2
19/6 am	plains*	2	10	11	8	0	31	26
19/6 pm	plains	12	195	29	39	0	275	8
20/6 am	forest	7	35	7	12	3	64	0
20/6 pm	plains	18	96	34	30	4	182	24
21/6 am	plains	11	34	24	15	0	84	32
21/6 pm	plains	28	95	21	37	3	184	57
22/6 am	forest	29	58	17	14	0	118	9
23/6 pm	plains	7	63	13	17	3	103	153
24/6 am	forest	12	24	11	6	0	53	95
24/6 pm	plains	21	92	32	33	1	179	244
Total		197	1035	260	315	19	1826	700
%		10.8	56.7	14.2	17.3	1.0	100	–
Block II		32	24	13	7	0	76	215
%		42.1	31.6	17.1	9.2	0	100	–

?? means un-classified. * only a partial count.

Table 3. Frequency of group size in Blocks I & II

Group size Block I	number	frequency	Block II number	Block II frequency
1	64	23.44	13	44.83
2	27	9.89	2	6.90
3	16	5.86	1	3.45
4	17	6.23	1	3.45
5	18	6.59	0	0
6	15	5.49	2	6.90
7	11	4.03	1	3.45
8	9	3.30	0	0
9	8	2.93	0	0
10–14	26	9.52	3	10.34
15–19	19	6.96	1	3.45
20–29	24	8.79	3	10.34
30–39	13	4.76	1	3.45
40–49	4	1.47	0	0
50–59	1	0.37	0	0
60–69	1	0.37	0	0
70–79	0	0	0	0
80–89	0	0	1	3.45
Total	273	100.0	29	100.0

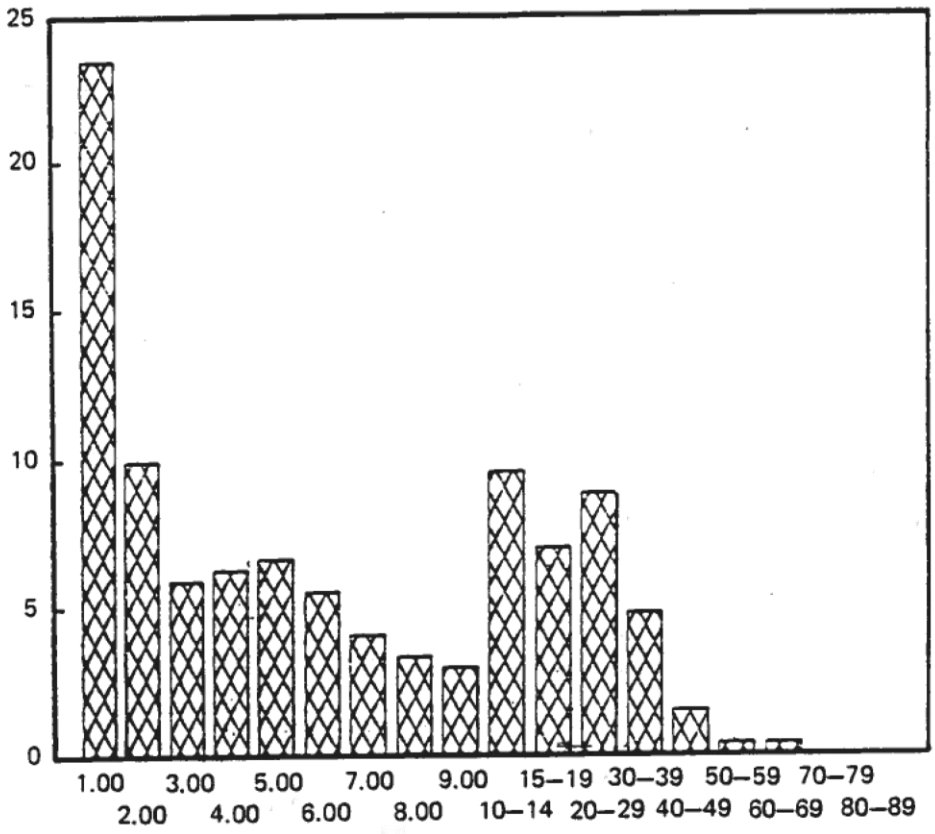


Fig. 6 Frequency diagram indicating grouping tendencies for water buffalo in Block I (N = 272 groups).

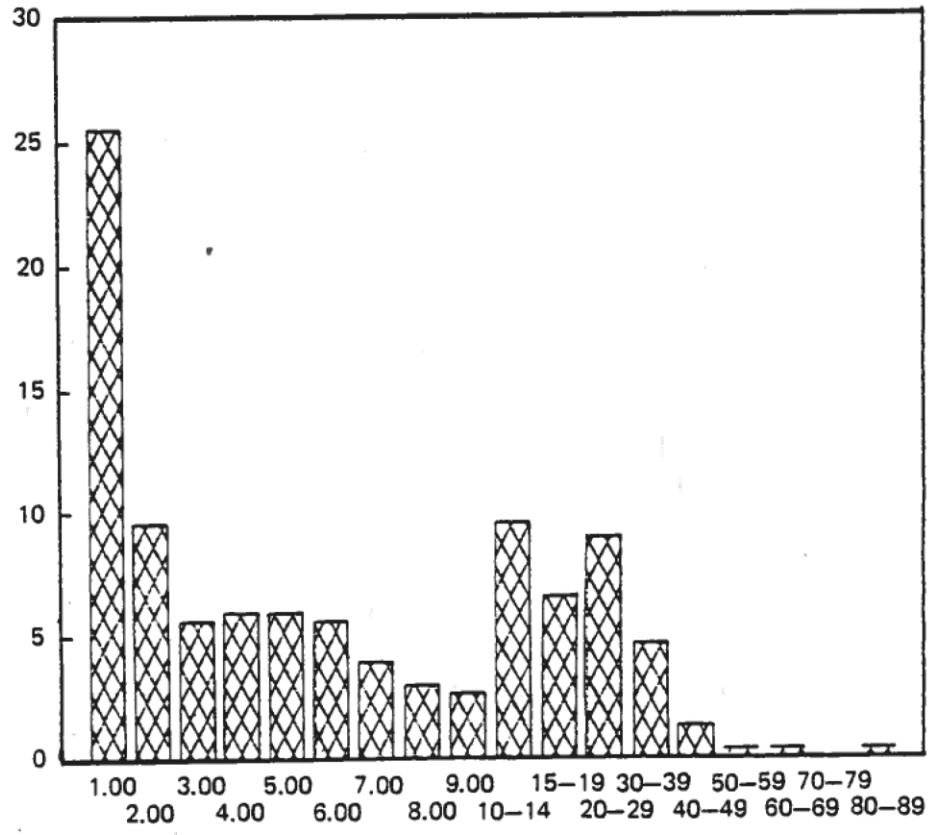


Fig. 7 Frequency diagram indicating grouping tendencies for water buffalo in Blocks I and II (N = 302 groups).

spaced, and sometimes long, marches does not exist. Besides, many of the water holes are associated with grazing areas which the buffalo utilize heavily in the late evenings.

The fact that there is no great need to migrate long distances in search of water throughout much of the year in Block 1 contributes to the formation of large aggregation in the plains such as Buttuwa, Wilapalawewa, Uraniya, Veppandeniya and Gonalabba. The larger the herd, more pasture is needed in any one locality. This explains the formation of large herds of more than 20 animals in these plains. The largest herd size observed in Block I was 64 in Buttuwa Plains while in Block II which has substantially larger grazing areas, it was 82.

Throughout much of the year, the grasslands along the coast bordering on the numerous water holes offer the buffalo and other herbivores including the elephant an ideal balance of good pasture and water. As the dry season progresses in intensity from end of May to the beginning of September, the large herds typical of the plains may split into a number of smaller units ready to commute between distant pasture and water. It is only when such regular commuting becomes necessary that the herd discipline becomes a paramount issue (Miloszewski 1983).

As in the case of the African buffalo *(Syncerus caffer)* the water buffalo in RNP also rumminate in large herds. A whole herd of say 80 animals does not rest in one group nor do all individuals rest alone. Adult males tend to rest apart from the herds unless they have acquired a harem during the period of rut. Juveniles and calves always tended to stay close to their mothers.

Group size is very variable within and between populations. Generally, animals living on open ground are found in larger groups than those living in forests (Dasman & Taber 1956). Large group-size may give more protection from predators (Leopard and crocodile), or disturbance in open areas.

As can be seen from Table 4, the number of herds without a single adult male accounted for 63% of all the observations (n = 162). The number of herds with a single adult bull accounted for 26% of the observations. This percentage will increase as the rut progresses in intensity.

5.1.2 *Population Structure:*

In Block I as the Table 2 shows, there are five times as many adult females on an average than adult males. However, this situation is reversed in Block II where for every one adult female, there were 1.3 adult males. One possible explanation is that a number of displaced males from Block I move over to the Block II where there is more pasture land and less competition from other adults. The number of juveniles in Block I was higher than the number of subadults. It would be interesting to see if this is so in the subsequent yearly census figures as it would then indicate that there is considerable mortality between the young and subadult stages. The number of calves was low: only 19 calves out of a total of 1,826 classified animals (or 1.04% of the population). This is in keeping with the observations carried out more than a decade ago by Santiapillai and Chambers in 1978 and 1979 when the number of calves observed in Block I in the month of July were 3 out of 269 (1.1%) and 0 out of 222 respectively (Santiapillai & Chambers

Table 4. Number of adult males per herd

No. of ad. males	0	1	2	3	4	5	6	7
No. of herds	102	42	6	7	2	0	2	1
%	63	26	3.7	4.3	1.2	0	1.2	0.6

1982). These observations indicate that the calving season was coming to an end in Ruhuna National Park. Adult males were seen examining oestrus females by smelling the urine and then displaying the characteristic flehmen posture, with the head held horizontal, neck extended. Flehmen appears to be a response to olfactory stimuli (Sinclair 1977).

5.2 *Sex ratio:*

The total number of animals sexed in the counts in Block I was 1,626 (out of a total of 2,526). Of this total, 197 were adult bulls (or 12.1%), 1,035 were adult females (63.7%) giving a mean sex ratio for the park of 1: 5 bulls to cows. But the observed sex-ratios in the park indicate that they could vary with the census times. In general, the ratio of bulls to cows increases in favour of the females in the evenings. In Block I, the ratios ranged from 1: 2 to 1: 16 (Table 5). As in any polygamous mammalian species, the natural sex-ratio is unlikely to be parity. In the case of the buffalo, the biased sex ratio in favour of the cows could well be attributable to the dispersion of adult males from the herds and the establishment of breeding territories. Other reasons for the numerical superiority of adult females in a buffalo population may be the sex-linked susceptibility of males to diseases (Miloszewski 1983).

From the point of view of management, what is important would be the recruitment. Recruitment can be measured as the number of animals between one and two years old (yearlings) per 100 females (Sinclair 1977). Because the mortality after two years old is small and relatively constant, the yearling proportion in the population can be taken as an index of the proportion that would reach sexual maturity. If this could be monitored yearly, it would give the park authorities reliable estimates on the rates of recruitment of young into the buffalo population in Ruhuna National Park.

5.1.2 *The Bachelor Males:*

Although buffalo aggregate in tightly knit herds, it is equally apparent that old males and even some younger ones in the case of the African buffalo live away from the herd. These Sinclair (1977) referred to as bachelors as they do not consort with the females. We found a similar situation in RNP where males lived apart from the female herds. Of the 273 herds tallied in Block I, 8 (about 3%) were all-male associations. The group size ranged from 2 to 17. Bachelor groups increase in size by the influx of males from other mixed herds.

In the Serengeti plains, the influx of the males coincides with the start of the dry season

Table 5. Age and sex ratio of the population of water buffalo in RNP.

time	total	bulls	100 cows	subad.	juvs.	calvs.	adm:adfm
17/6 pm	172	13.3	100	21.9	28.6	0.0	1: 7.8
18/6 am	156	25.6	100	16.3	37.2	2.3	1: 3.9
18/6 pm	225	9.9	100	16.9	29.6	2.1	1: 10.1
19/6 pm	275	6.2	100	14.8	20.0	0.0	1: 16.3
20/6 am	64	20.0	100	20.0	34.2	8.6	1: 5.0
20/6 pm	182	18.8	100	35.4	31.3	4.2	1: 5.3
21.6 am	84	32.3	100	70.6	44.1	0.0	1: 3.1
21/6 pm	184	29.5	100	22.1	39.0	3.2	1: 3.3
22/6 am	118	50.0	100	29.3	24.1	0.0	1: 2.0
23/6 pm	103	11.1	100	20.6	27.0	4.8	1: 9.0
24/6 am	53	50.0	100	45.8	25.0	0.0	1: 2.0
24/6 pm	179	22.8	100	34.8	35.6	1.1	1: 4.3

and with the fragmentation of the breeding herds into smaller units (Sinclair 1977). It also coincided with the end of the rutting season. In RNP, it is most likely that the males move into the herd only during the rutting season. The older males also tend to leave the herd and live in smaller groups. As the body weight declines with age, the reproductive ability too reduces and this would preclude the animals return to the herds. It appears that the animals in a bull herd are more susceptible to predation than those in mixed herd (Prins 1987).

As the lactating cows need better food because of pregnancy and initial calf survival, it would not be too surprising if mechanisms had evolved within the buffalo social organization whereby the females were found in better habitats than do the males.

5.3 *Activity pattern:*

Table 6 gives the periods when water buffalo were seen grazing, wallowing or ruminating. As can be seen from Fig. 8, the activity of the groups picks up rapidly in the late evenings and reaches a peak about 1700 hrs. The solitary animals tend to be active throughout the day but between 1300 and 1500 hrs, both solitary animals and groups seem to retire within the forests to escape from the heat.

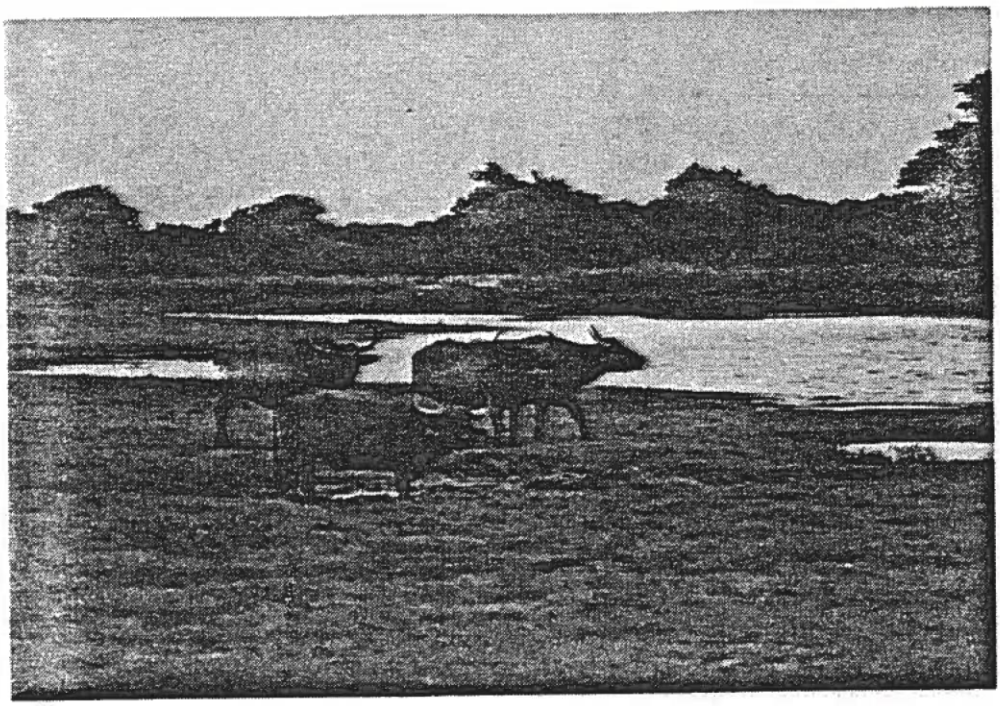
5.4 *Density and Biomass:*

Density refers to the number of animals in a particular area at a given time. By itself, it may indicate whether there are many or few animals. But it becomes very meaningful if it can be compared with other estimates or if the census can be repeated, for then we may be able to determine whether a population is stationary, or is in a state of change (Spinage 1982). It is here that the density of buffalo becomes important to give an insight into the habitat requirements of the species.

In the estimation of crude density, we took the maximum number recorded both within the thorn scrub (169 animals) and in the open plains (423 animals). A total of 592 animals thus counted in an area of 140 km2 gives a crude density of 4.2 buffalo per km2. This gives a crude biomass of 1,890 kh per km2. The crude density despite its short comings is a good index of the population useful in

Table 6. Period of activity observed in the water buffalo population.

Time	no. of solitaries	frequency	no. animals	frequency
0600	2	2.90	48	1.95
0700	5	7.25	183	7.45
0800	0	0	20	0.81
0900	8	11.59	147	5.98
1000	3	4.35	116	4.72
1100	0	0	59	2.40
1200	0	0	90	3.66
1300	0	0	0	0
1400	0	0	0	0
1500	0	0	6	0.24
1600	17	24.64	401	16.31
1700	15	21.74	879	35.76
1800	19	27.54	509	20.71
Total	69	100.00	2,458	100.00



A small herd of wild water buffalo in the Ruhuna National Park, Sri Lanka (Photo: Charles Santiapillai)

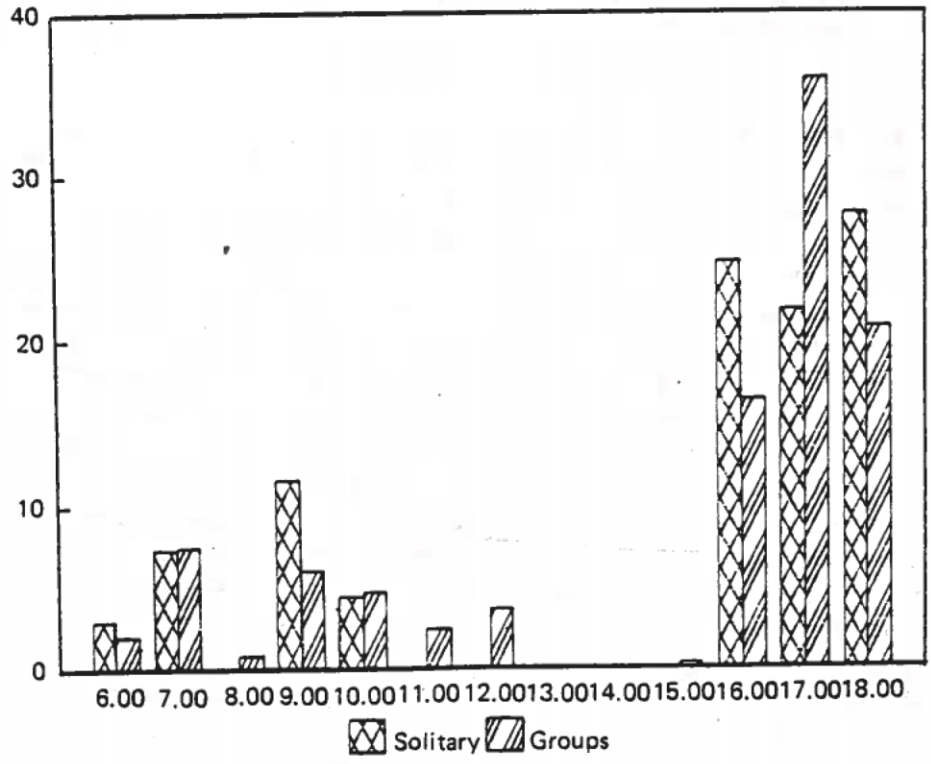


Fig. 8. Activity patterns of the solitary animals and the groups of buffalo in RNP.

future comparisons. It is less suscpetible to errors than biomass figures as the latter is usually derived simply from adult weights without any reference to the population structure. It is likely that Block I may harbour seasonally higher densities of water buffalo. But the number of buffalo are likely to be still in the hundreds and not in thousands as previously speculated.

6. *Conclusion:*

The results to date indicate that the water buffalo numbers are not unduly high and that the species is not in competition with the other large herbivores in the park to any important extent. Its numbers appear to be well controlled by environmental factors. However, given the gregarious habits and its largely sedentary life style, the water buffalo may cause overcrowding if additional water holes were to be established. So the lesson from the initial survey is that park authorities must not create any further water holes in Block I. The number of water holes currently available are more than enough to satisfy the demands of the herbivore community.

There is however a danger of domestic herds of buffalo straying into the park across the south-eastern and western boundaries. Contagious diseases spread by, domestic animals have been one of the main reasons for the disappearance of the wild buffalo in peninsular India (Daniel & Grubh 1966). Rinderpest almost wiped out the Wild buffalo in the Central Province of India. As it is not feasible to innoculate cattle against all communicable diseases, it is better to prevent the domestic grazing stock from entering the park than cure the subsequent eruption of diseases. One of the recommendations for the WWF-International is to assist the Department of Wildlife Conservation in Sri Lanka in setting up electric fencing as a pilot project along the south-eastern boundary from the Park gates to the sea in an effort to prevent the domestic cattle from moving into Block I.

The vegetation around the water holes in Block I appears to be closely cropped but there does not seem to be any large-scale damage to it. Over-grazing is not a result of buffalo activity alone in Block I. Herds of elephants also feed on the same grasslands and their scarification of the ground leaves many areas of bare patches, devoid of vegetation. Grazing may thought to promote the growth of unpalatable plants. But even if this is the case, as Sinclair (1977) points out, it should be regarded as part of the natural and normal vegetation response towards grazing. This could then result in a negative feedback regulating the grazing pressure so that plant cover is maintained and soil erosion is avoided. From the national parks standpoint, Sinclair (1977) argues that the increase of relatively unpalatable species in the vegetation should be considered as a normal and perhaps desireable response to heavy grazing.

The study reported here is just a beginning. Much more needs to be done in Ruhuna National Park to safeguard the park's fauna and flora. Constant monitoring of the population of the buffalo and its impact on the forest vegetation must be a part of the park's principal aims in management. To carry out this on a regular basis, the park needs funds and trained manpower. Ruhuna National Park is run on a very small budget by a small group of extremely dedicated staff who are committed to controlling poaching and monitoring the visitors. The income from the tourists is largely diverted to the Treasury and very little finds its way back into the park. Hardly any budget is available in the park for funding surveys. It is here that the International Conservation Organizations such as WWF could assist the park authorities through the provision of small but tangible financial assistance. In the final analysis, scientific and technological expertise is worthless, if the money and resources required to implement the expertise is absent.

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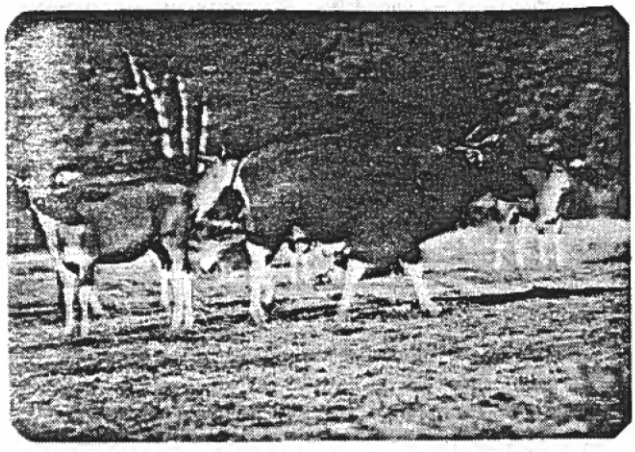

An adult bull banteng (Bos Javanicus) and young females in Ujung Kulon National Park. West Java, Indonesia. (Photo: Alain Compost)

Investigation of the Status of the Wild Water Buffalo of Ruhuna National Park and its Ecological Niche relative to the those of the other large artiodactyl herbivores

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HISTORICAL

There has been a perception among many involved, of the water buffalo of Ruhuna National Park being at the least over abundant and perhaps being a feral intruder having no rightful place in its ecosystem, which dates back several decades into the period before independence. It was sometimes implied or even openly stated that buffaloes by wallowing were dirty animals fouling the drinking water of the other species, particularly deer. Furthermore wildly exaggerated stories were given credence in journals respected abroad (Loris 1973) suggesting that the buffalo was undergoing a population explosion. The matter came to a head in 1980 when Dr. M. Woodford refused a request to FAO for grant aid and technical assistance in capturing and removing a substantial population of the buffalo present, until there had been a reliable census. The Sri Lankan Wildlife Conservation Department in turn refused an offer by FAO to carry out an aerial census.

At that time Drs. Santiapillai and Chambers were already indicating provisionally on the basis of visual counts from vehicles particularly at waterholes, that the number of buffalo (and likewise of wild pig) was much lower than believed, and that the rate of breeding of buffalo was low. They also gave an estimate of the number of axis deer in Block I. The limitation of the method was that the figures were minima as individuals in the bush could not be observed. Dr. Ashby became involved in 1981 when he suggested that conditions at Yala Block I (and II) appeared excellent for finding and collecting skulls of buffalo that had died, to form a pick-up collection. Sectioning molar teeth from these skulls to observe layering in the cementum is long established as a method of determining age at death in ruminant antiodactyls living in markedly seasonal climates. It was originally used in high latitudes where winter is the unfavourable season, when growth in the cementum stops, giving a dark layer. It was later found that the dry seasons in the savannahs of Africa had the same effect. The present instance was the first for using the method in Asia. If (a) the age of attainment of sexual maturity is known and (b) juvenile mortality can be discounted by visual observations, and (c) the mean breeding success of females likewise observed, then if (d) the mean age of death of those that attain adult hood can be determined, the mean number of female offspring produced per female and surviving to breed can be estimated. If this is greater than 1.0 numbers are increasing, if it is less than 1.0 they are falling. The data resulting showed that the number of buffalo was stable. The reliability of this conclusion is proved by the recent census by Dr. Santiapillai showing that the number of buffalo present in Block I is the same as ten years ago. The fears of an exploding population were therefore groundless. Dr. Ashby has suggested that the appearance of overgrazing in Block I is due not to any increase in number of buffalo but to enlargement and deepening of water holes, done to improve game-viewing, encouraging buffaloes to remain there in the height of the dry season instead of moving elsewhere.

Technique to determine age

Skulls of buffalo were collected almost entirely from the vicinity of water holes and in the bed of the Menik ganga, suggesting that they rarely

died elsewhere. In the searches, skulls of sambar deer, axis deer and pig were also collected as the basis for ancillary studies. Prior to the attainment of the adult dentition and the full growth of the skull, age of buffaloes can be estimated from the pattern of eruption of teeth and the growth in length of the lower jaw, which follows the pattern in domestic cattle. The rate of the survival in the early months must however be estimated from visual counts, as the skulls of juveniles are largely destroyed by leopard, pig and crocodile acting as predators and scavengers. This applies to deer and to pig also.

Estimates of age from layering in the cementum can commence with specimens dying at one year, when eruption of the first molars (M1) is completed. This is the simplest tooth to use, but M2 and M3 which erupt approximately 0.5 and 1.0 year later, can also be used. Teeth in the lower jaw are used for preference as their roots are in a linear row, but upper molars can be used if the lower jaw is missing. The tooth is sectioned vertically between roots, a half tooth removed and its cut surface polished with a coarse and then a fine grade of carborundum powder, and the layering pattern observed under a strong directional light (sunlight is ideal) under a x 12 handlens. A low power microscope can also be used. More sophisticated techniques involving decalcification, sectioning and staining can also be used but these methods are laborious and their adoption has been found to be unnecessary.

In addition to the determination of layering in the cementum, a number of other characters of the dentition changing with age in adult life were measured. The thickness of the cementum increases on a linear basis as more layers are added. The other parameters estimated are all correlates of wear. The general appearance of the dentition as a whole was estimated on a nine point scale published by G. Schaller in *The Deer and the Tiger 1967*. After some experience each band was subdivided into three. The height of dentine remaining in M1, where wear is most intense, provides directly a numerical index of wear. The height of the lateral cusps of M1 is another such measure much used by researchers on deer species. It was found to be well correlated with age in sambar and axis deer, but not in buffalo.

The methods described above apply equally in sambar and axis deer. Finally they were applied to pig, which had not been attempted elsewhere in the range of the species. There is not in pig the concentration of dental wear of M1 which is found in the ruminants, so here the numerical estimates of wear of this tooth are less significant.

Results from Dental Observations

Buffaloes

Clear layering occured in the cementum in 90% of individuals, with there being alternating strongly weakly marked dark layers, attributable to the main and subsidiary dry seasons. The data indicate a moderate neonatal mortality, then a low death rate until about seven years of age. From then onwards mortality rises progressively, with these being no survivor beyond 13 years. This is only a third of the longevity reached by buffalo on farms. Wear of the dentine of M1 is rapid, this being reduced from a height of 6 to 2 cms between an age of 1.5 and 5.5 years and to an average of 1 cm four years later. The addition of cementum below the dentine reaching a depth of 0.7 cm by eight years of age, provides some compensation, but there is a presumption that after that age there is a progressive fall in the efficiency of the dentition and that this loss of efficiency combined with the low quality of the grazing during the main dry season, accounts for the disappearance of all individuals at an age when in other respect one would expect them to be still in the prime of life.

Another feature of the life table of buffalo is that the mortality pattern of males and females is indistinguishable, whereas the numbers of adult females observed is much greater than that of adult males. The paradox is reconciled by the visible adult males being dominants holding territories in prime sites on the open grasslands. The subordinate males are elsewhere out of the sight.

Sambar deer

The sambar offers a sharp contrast to buffalo in many respects. The rate of wear of the dentition is very much smaller, attributable to it as a browser taking much less silica in its diet than the buffalo, which feeds on harsh grass material in dry periods and takes in grit when this is close cropped. All the lines in the cementum are of similar intensity in sambar, so there is presumably only one formed each year. The general absence of a dark layer formed in the subsidiary dry season in sambar may be attributed to browse being little affected by a short period of dry weather. Subsidiary lines were however formed in the last years of a few individuals which died at an advanced age, presumably owing to loss efficiency of their dentition.

The mortality rate is very low between one and ten years, then moderate to about 15 years and then high subsequently, with the oldest individuals observed being in the low 20s. This is very similar to the pattern observed in *Cervus elaphus* (red deer) in Europe and North America, with a mean age at death of about 12 years. No observations have been possible on the neo-natal and juvenile mortality of sambar, but either it must be much higher than in buffalo if there is one young born each year from an early age or, as in red deer, the female does not give birth until it is several years old.

Direct censussing of sambar has not been practicable. The majority of skulls were found on the sand dunes, which are known to be much visited by sambar in the early morning. Night viewing equipment would be needed to study this activity. As the skulls of buffalo and sambar are of fairly similar size, it may be assumed as a working hypothesis that they take equally long to decay. Taking into account that the number of sambar skulls found was rather over half the number of buffalo skulls, and that sambar on average live twice as long, it may again as a working hypothesis, be assumed that the abundance of buffalo and of sambar in Block I are about the same.

Axis (spotted) Deer

All the lines in the cementum appear similar, so it is concluded that one is formed per year as in sambar. The rate of wear of teeth also follows the pattern in sambar. It may be presumed that although the species does graze, browse is the main food at the height of the dry season when grass is of poor quality. This could be checked by faecal analysis, allowing for the results of such analysis being biassed against the amount of the softer foods in the diet.

The life table is closer to the pattern in sambar than to that in buffalo, but the maximum longevity is rather less at about 15 years. Conclusions are tentative as the sample size of teeth sectioned from different individuals is fairly small at 50+.

Pig

The sample size is small at 20, so to allow for the possible effect of random errors, conclusions drawn must be tentative. The small number of skulls collected is in accord with the conclusion of Santiapillai that the abundance of adult pig is much less than that of buffalo or of either species of deer. Once adult, the pattern of mortality of pig appears to be similar to that of the buffalo with the maximum age reached being about twelve years, and the dentition being heavily worn in old individuals. Again as in buffalo there is a subsidiary dark layer laid down in the cementum each year. There is however a sharp difference from the buffalo in the breeding pattern. The pig has a litter of several young each year, which suffer a heavy mortality in the early months from predation.

Conclusion

Each of the four species buffalo, sambar, axis and pig has a clearly defined niche. In some respects the niches occupied by buffalo and pig appear to be closer to each other than to those of either species of deer, but the apparent si-

milarity reflects only that they both feed at ground level and are not browsers to an important extent. Their diets are nevertheless sharply different, with the buffalo being a straightforward grazer and the pig digging for roots and bulbs, and being an effective scavenger. With the buffalo being large and having a wide mouth there is a presumption that it is not highly selective in its feeding.

The results to date indicate that the buffalo is not in competition with the other herbivores to any important extent, that its numbers are well controlled by environmental factors, and that it is a valuable member of the ecosystem. Any implied comparison with Northern Australia where it is a genuine alien in the setting of a very different flora, is misplaced.

Suggested Future Studies

(1) An immediate priority in the consolidation of work to date. The obvious need is the collection of futher pig skulls to give a firmer statistical base to life table data. The desirable sample size on which to base a life table is usually given as about 200. The skeletons of the pig which died of swine fever two years ago offer a readily available source. The sample sizes of buffalo at 130+, sambar at 80+ and in particular axis at 50+ would all also benefit from amplification. The financial outlay would be small, and the technique involved is simple and requires no sophisticated equipment. There is the added consideration that if the proposed course on Wildlife Ecology at Peradeniya University is instituted, a well organised skull collection in particular of buffaloes will provide practical material for students.

(2) Lack of knowledge of systematic status of the wild buffalo of Sri Lanka is a major gap. It is known only that the buffaloes of Sri Lanka share the wallowing habits of the swamp subspecies found in South-east Asia but that in the domestic variety in Sri Lanka the chromosome number is the same as in the river buffalo found in Northern India and differs from that in the South east Asian form. The chromosome number of the wild buffalo in Sri Lanka is unknown. The possibility of determining this was discussed with Dr. M.B.A.O. Perera in 1985 but was not followed up because amongst other reasons, he said that the only person in Sri Lanka capable of the study was abroad. Since that time there have been developments in terms of finger-print type of genetic analysis, and also in darting techniques which make it possible to obtain biopsy specimens of skin without needing to capture individuals. These techniques do however require specialised personnel and equipment for tissue-culturing and genetic analysis in the laboratory and for the darting. Dr. Sunnocks of the Institute of Zoology of London Zoological Society has expressed interest in principle in being involved. Any detailed proposal would need discussing and planning with him and his team in conjunction with all involved in Sri Lanka.

The immediate aim would be to compare the genetics of wild and domestic buffalo in Sri Lanka, with any extension to continental Asia being a later development. The samples required can be either blood or skin. Of possible assistance is the fact that numbers of wild buffalo in Yala were captured and transferred to farms some years ago. If these individuals can now be *reliably* traced, it appears possible that in the first instance, blood samples of the wild form could be obtained from them and the need to use the darting technique could be avoided. Apart from the intrinsic value of the knowledge of the genetics of a species which is of enormous economic importance, there is the prospect of the information obtainable bearing on the controversies concerning whether the wild buffalo of Sri Lanka is likely to be native or introduced and concerning the closeness of its relationship with the domestic form, and hence result in a reassessment of the conservation value of the species.

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Sign and habitat impact of banteng *(Bos javanicus)* and pig *(Sus scrofa)*, Cobourg Peninsula, northern Australia

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Abstract

The habitat preference and impact of banteng *(Bos javanicus)* and pigs *(Sus scrofa)* in Gurig National Park, on Cobourg Peninsula, Northern Territory, was investigated by systematically sampling twelve habitats. Animal signs (banteng and pig scats) and impacts (area of rooted, trampled or pugged ground and number of rubbed tree trunks) were recorded in 696 quadrats, each 5 X 20 m. Significant differences among habitats in sign and impact were detected. Pig rooting was concentrated on wetland communities, particularly sedgelands. Banteng sign focused on monsson forest and coastal plains, where they caused less obvious damage than pigs. There was little evidence of either ungulate in the eucalypt communities, which are the most widespread of all habitats on the peninsula.

In monsoon forests, banteng densities were approximately 70 per km^{-2}. Banteng, unlike pigs and buffalo, have remained near their point of introduction over the last 140 years, possibly because of the unique habitat mosaic consisting of grasslands abutting monsoon forest.

(Source: Australian Journal of Ecology (1991) 16, 15–17)

A MAJOR STUDY OF THE WILD CATTLE IN INDONESIA

Mr Simon Hedges (a member of the IUCN/SSC Asian Wild Cattle Specialist Group) is a biologist from the University of Southampton, England. He and his colleague, Mr Martin Tyson (also a biologist from the University of Southmpton, England) plan to carry out a detailed study of the ecology and behaviour of the Banteng *(Bos javanicus)*, an endangered species of wild cattle, and their interactions with the Javan rhino *(Rhinoceros sondaicus)*, feral water buffalo *(Bubalus bubalis)* and rusa deer *(Cervus timorensis)* in Java. Their study is designed for a three-and-a-half year period and will be carried out in Baluran and Ujung Kulon National Parks.

The research project has the following aims according to Simon Hedges:—

AIMS

The overall aim of the project is to understand the functioning of the ungulate communities within the Baluran and Ujung Kulon ecosystems so that they can be managed to maintain viable populations of banteng and Javan rhino — the most important species, from a nature conservation point of view — in these National Parks. The project will focus on the status, ecology and behaviour of the banteng and rhino paying particular attention to their interactions with each other and with feral water buffalo and rusa. The behavioural ecology of buffalo and rusa will also be studied

More specifically over the three-and-a-half year period the research team will investigate:

1. The numbers of each of the four species in Baluran and Ujung Kulon.
2. The population characteristics of the four species, including sex and age structure, reproductive success and mortality.
3. The range use and habitat selection of the four species and any temporal changes or differences between the sexes and age classes.
4. The food preferences and feeding behaviour of the four species and the extent of overlap. The possibility that facilitation is occurring will be investigated. Temporal variation and individual differences between the sexes and age classes will be taken into consideration.
5. Utilisation of water resources by the four species and more generally the impact of variation in the local climate, especially precipitation.
6. Aspects of social and reproductive behaviour.
7. The prevalence of disease and parasitic infestation.
8. The effects of grazing by these four herbivores on the vegetation of the two parks.
9. Hunting pressure within and in the immediate environs of Baluran and Ujung Kulon.
10. The effect of predation on the populations of the four species.
11. The impact of the buffalo removal programme in Baluran and the impact of tourism on the four species in the two parks.
12. Incidental observations will be made on the other fauna of the two parks.

Historical sources of information, for example hunting records, climatic data, old aerial photographs and satellite images will be collated along with information relating to the development of human settlements within the area. This will enable us to gain a better insight into the stability of the Baluran and Ujung Kulon ecosystems.

COOPERATION

This programme of work will be carried out in conjunction with the Forestry and Nature Consevation Project (FONC) of the Netherlands-Indonesia Inter University Programme of Cooperation. As such it will be a joint venture between: the Facultas Kehutanan, Universitas Gadjah Mada (UGM), Yogyakarta in Indonesia; the Department of Nature Conservation at Wageningen Agricultural University (WAU) in the Netherlands; and in this case the Biology Department at Southampton University (SU) in the United Kingdom. The work will be discussed with staff from the World Wide Fund For Nature (WWF) Indonesia Programme and the Indonesian Directorate General of Forest Protection and Nature Conservation (PHPA). The field work will be conducted in cooperation with the staff of Baluran and Ujung Kulon National Parks. In addition another graduate student from Southampton University, Martin Tyson, will be employed as a research assistant.

The results of this research will be published and widely disseminated in both Europe and Indonesia. In addition I will submit a report to Wageningen Agricultural University in the Netherlands (WAU) as a doctoral thesis. This aspect of the project will be jointly supervised by Drs S.de Bie of the Department of Nature Conservation at WAU and Dr R.J.Putman of the Biology Department at Southampton University in the United Kingdom.

A number of Indonesian graduate student counterparts from UGM will be involved in the project. They will be investigating the ecology of the savannah vegetation with special emphasis on the grasses, herbs and *Acacia* species and it is anticipated that there will be extensive cooperation with these students. In addition it is expected that many other students from UGM and WAU will take advantage of this research programme by spending time in the field with the project members thus gaining valuable experience of wildlife ecology.

More generally it is hoped to strengthen links between Indonesian, Dutch and British universities and to encourage research into tropical wildlife resources.

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A NOTE FROM THE EDITOR

The IUCN/SSC Asian Wild Cattle Species Specialist Group plans to publish the Newsletter on a regular basis at least twice a year. The Newsletter is published with financial assistance provided by the Asia Programme of WWF-International and is distributed free of charge to members and other interested people and conservation agencies.

No publication of this nature can be maintained without the active support and participation of the members. What is needed most is your contribution in the form of news-worthy articles on the status of the wild cattle in your region. I would appreciate very much if every one of you could send me whatever information you could obtain on the wild cattle species in your area, the threats they face and the conservation measures that are being adopted (or need to be adopted) to ensure their long-term survival in the wild.

Of particular use would be summaries of any research work that you have carried out on wild cattle for publication in the Newsletter.

Without your contribution, it will be almost impossible to maintain such a publication even with financial assistance from WWF-International. (I have managed so far to produce 4 issues of the Asian Wild Cattle Specialist Group Newsletter without much input from any member. But there are strict limits to this versatility). So please do send me whatever material you can obtain so that it can be shared with other members through the medium of this Newsletter. I would also welcome your critical letters with suggestions for improvement of the Newsletter.

Thank you for your co-operation.

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