CONSERVATION AND MANAGEMENT OF FRESHWATER TURTLES AND LAND TORTOISES OF INDIA

FINAL REPORT

TURTLE AND TORTOISE CONSERVATION PROJECT
A JOINT INDO-US COLLABORATIVE PROJECT
OF
THE WILDLIFE INSTITUTE OF INDIA AND
THE U.S. FISH & WILDLIFE SERVICE

S.BHUPATHY, Research Biologist
B.C.CHOUDHURY, Principal Investigator
E.O.MOLL, Project Advisor

WILDLIFE INSTITUTE OF INDIA
POST BAG NO. 18,
DEHRA DUN, INDIA

1999

CONTENTS

Acknowledgements

Executive Summary

Chapter I. Indian freshwater turtles and land tortoises

Chapter ii. WII-USFWS freshwater turtle and land torotise conservation project

Chapter iii. Status and distribution of Indian freshwater turtles and land tortoises in various biogeographic zones

Chapter iv Exploitation of freshwater turtles and tortoises

Chapter v Freshwater turtles and land tortoises in captivity and ex-situ conservation

Chapter vi Status and distribution of chelonians in various states and action plans

Chapter vii Status assignment of freshwater turtles and land tortoises

Recommendations

Literature cited

Appendices

Be

Notes:

1) The Document file name : Turtle.WPD

2) Laser jet frmat - WP [Window ver. 6a]

3) Maps may be corrected/ [original map disketts with Bc.]
modified.

20/7/98
(S. Bhupathy)

List of Tables and Appendices

Table 1.	Biogeographic representation of survey localities.
Table 2.	Turtle species recorded in the Himalaya Biogeographic Zone
Table 3.	Status of chelonians in the Indian Desert
Table 4.	Turtle fauna of Semiarid Biogeographic Zone
Table 5.	Status of turtle in the Western Ghats Biogeographic Zone
Table 6.	Turtle fauna of the Deccan Peninsula Biogeographic Zone
Table 7.	Status of turtles in the Gangetic Plain Biogeographic Zone
Table 8.	Turtle fauna of Coastal Biogeographic Zone
Table 9.	Status of turtles in the Northeastern India Zone
Table 10.	Turtle exploitation records in India during 1991-93; *Price in pet market is Rupees/turtle*
Table 11.	Turtle trade records in Calcutta between September 1991 and January 1992
Table 12.	Turtles confiscated by wildlife officials in Calcutta between 1991 and 1993
Table 13.	Frequency occurrence of markets having turtle species in india during last 10 years
Table 14.	Status of turtle and tortoises in Indian Zoos/Captive Breeding Centres (CBC)
Table 15.	Breeding records of chelonians in Indian Zoos and Captive Breeding Centres (CBC).
Table 16.	Turtle status and Action Plan: Andhra Pradesh
Table 17.	Turtle status and Action Plan: Bihar
Table 18.	Turtle status and Action Plan: Gujarat
Table 19.	Turtle status and Action Plan: Hariyana
Table 20.	Turtle species status and Action Plan: Himachal Pradesh
Table 21.	Turtle status and Action Plan: Jammu and Kashmir*
Table 22.	Turtle species status and Action Plan: Karnataka
Table 23.	Turtle status and Action Plan: Kerala
Table 24.	Turtle status and Action Plan: Madhya Pradesh
Table 25.	Turtle Status and Action Plan: Maharastra
Table 26.	Turtle status and Action Plan: Northeast India
Table 27.	Turtle status and Action Plan: Orissa
Table 28.	Turtle status and Action Plan: Punjab
Table 29.	Turtle status and Action Plan: Rajasthan
Table 30.	Turtles status and Action Plan: Tamil Nadu
Table 31.	Turtle species status and Action Plan: Uttar Pradesh
Table 32.	Turtle status and Action Plan: West Bengal
Table 33.	Distribution of freshwater turtles and land tortoises in different biogeographic zones and states in india
Table 34.	Habitats of the Indian freshwater turtles and land tortoises
Table 35.	Factors used for status assignment of Indian turtles
Table 36.	Factors used for status categorisation of freshwater turtles and land tortoises
Table 37.	Indian turtles - proposed legal status with explanation.

Appendix I.	Indian turtles: present (1993) conservation and legal status
Appendix II.	Publications
Appendix III.	Turtle/tortoise specimens examined at National Museum, Calcutta and at the museum of Bombay Natural History Society, Mumbai.
Appendix IV.	Area surveyed and their location in biogeographic zone
Appendix V.	Resource persons utilized for various survey sectors

List of figures

Fig. 1 Distribution of Indian turtles
Fig. 2 Biogeographic zones of India
Fig. 3 Schematic diagram: Survey methods
Fig. 4 Himalayan biogeographic zone showing survey localities
Fig. 5 Indian desert and Semiarid zones showing survey localities
Fig. 6 Western Ghats zone showing turtle survey localities
Fig. 7 Deccan peninsula showing turtle survey localities
Fig. 8 Gangetic plains showing survey localities
Fig. 9 Coastal zone showing turtle survey localities
Fig. 10 Northeast India zone showing survey localities
Fig. 11 Markets surveyed for turtles trade
Fig. 12 Andhra Pradesh showing turtle survey localities
Fig. 13 Bihar showing turtle survey localities
Fig. 14 Gujarat showing turtle survey localities
Fig. 15 Punjab and Harayana showing turtle survey localities
Fig. 16 Karnataka showing turtle survey localities
Fig. 17 Kerala showing turtle survey localities
Fig. 18 Madhya Pradesh showing turtle survey localities
Fig. 19 Maharashtra showing turtle survey localities
Fig. 20 Northeast India showing turtle survey localities
Fig. 21 Orissa showing turtle survey localities
Fig. 22 Rajasthan showing turtle survey localities
Fig. 23 Tamil Nadu showing turtle survey localities
Fig. 24 Uttar Pradesh showing turtle survey localities
Fig. 25 West Bengal showing turtle survey localities

ACKNOWLEDGEMENTS

We thank the Indo-US Sub-Commission on Science and Technology and the Ministry of Environment and Forests, Government of India for sanctioning this project. We are grateful to Mr. H.S. Panwar, formerly the Director, Wildlife Institute of India (WII), Dehra Dun, Mr. David Ferguson of the US Fish and Wildlife Service for their continued support to the project and encouragements. Mr V. V. Nandi, Science Officer, American Embassy, New Delhi helped us in various ways for the successful completion of this project.

We are grateful to the Chief Wildlife Wardens of all survey states for permission to work in the Protected Areas and logistics in the field. The success of this project is mainly due to the country-wide support received from all forest officials and field officers. Zoo Directors and staff supported us by providing information on turtles in their collection.

We thank the Director, Zoological Survey of India, Calcutta and Director, Bombay Natural History Society (BNHS), Mumbai for permitting us to examine turtle specimens deposited in their museums. Mr. J.C.Daniel, formerly the Director, BNHS and colleagues working at various institutions helped us while conducting the field work (*see Appendix xx*). We thank each one of them.

We thank Messers. Kishore Rao and H.S. Pabla, Nodal Officers of the Indo-US Projects and Mr. S.K.Mukherjee, Director, WII for helping us in executing this project. We thank all collegagues at WII for their help, cooperation and encouragements all through the project period.

(**BC:** *I might have missed a number of colleagues who had helped us. I leave to you for addition or deletion, the order or tone of the mention may be changed as you wish !).*

EXECUTIVE SUMMARY

A three year study of the Wildlife Institute of India (WII) and US Fish & Wildlife Service (USFWLS) collaborative project on the Conservation and Management of Freshwater Turtles and Land Tortoises in India was launched in May 1991. Major objectives of the Project were, (1) to determine the current status of tortoises and freshwater turtles in India (2) to identify viable turtle populations and suitable habitats to establish Protected Area (3) to set up captive breeding units for endangered chelonians aimed at reintroduction, and (4) to provide scientific information and training to biologists and managers on turtle conservation and biology.

Data on the current status, exploitation and captive breeding of turtles were collected by questionnaire and field surveys. A museum survey was conducted before initiating field surveys to determine the present distribution of little known turtle species. Sixty-one markets were surveyed covering most parts of the country to determine the exploitation pressure on turtles. The Indian flapshell (*Lissemys punctata*), Indian softshell (*Aspideretes gangeticus*) and Indian peacock softshell (*A. hurum*) turtles are being exploited but in low quantity. An inventory on the captive stocks of turtles in Indian zoos was prepared based on a questionnaire survey. Feedback were received from 36 zoos. Commonly exhibited species in zoos were the Indian starred tortoise (*Geochelone elegans*) and *Lissemys punctata* .

Sixty-two geographic localities (46 Protected Areas) covering all but two biogeographic zones were surveyed during the present study and information on turtle status collected. Significant range extensions were recorded for several endangered species such as *Aspideretes hurum,* Narrow-headed softshell turtle *(Chitra indica),* Asian leaf turtle *(Cyclemys dentata),* Tricarinate hill turtle *(Melanochelys tricarinata),* Cochin forest cane turtle (*Geoemyda silvatica)* and Travancore tortoise *(Indotestudo forstenii)*. A detailed analyses was done on the status of chelonians at biogeographic and state levels and action plans proposed. A new status listing is suggested for turtles and tortoises to incorporate in the Indian Wildlife Protection Act (1972).

A workshop on the Freshwater Turtle and Land Tortoise Conservation Research and Management was conducted at Gwalior and National Chambal Sanctuary, Madhya Pradesh during March 10-13, 1993 to disseminate the information collected during the present study.

CHAPTER I

INDIAN FRESHWATER TURTLES AND LAND TORTOISES

REVIEW OF LITERATURE

Reptiles in general are poorly studied in India and elsewhere in the Southeast Asia. Fauna of British India series by Smith (1931-43) remained the only reference book on the distribution and general ecology of the Indian reptiles till recently. Interest on the Indian chelonian study gained momentum in early eighties with the launching of country-wide freshwater turtle survey by Dr.Moll and his associates. Several publications resulted from this one and half year study in India especially in Gangetic plains and southern India and, a management plan drafted for the conservation of Indian chelonians (Moll 1991). Descriptive papers on the then little known genus *Kachuga* were published (Moll 1986,1987). This study also resulted in the redescription of Cochin forest cane turtle, *Hoesemys silvatica* as *Geoemyda silvatica* (Moll et al 1986) and description of a new subspecies (*Kachuga tentoria pallidipes;* Moll 1987), and extension of ranges of several Indian species (Moll and Vijaya 1986). Webb (1980) redescribed the Indian flapshell turtle (*Lissemys punctata*) which resulted in the change of subspecies name. Apart from these, Moll's study created awareness among young Indian herpetologists.

Subsequent to the above mentioned country-wide survey, several short surveys were undertaken by various institutions. The Bombay Natural History Society (BNHS) conducted a turtle survey in the Eastern Rajasthan (Bhupathy and Vijayan 1991) which resulted in the range extension of the Indian peacock softshell turtle, *Aspideretes hurum* (Bhupathy and Ajithkumar 1988). Northeastern India was surveyed by Indraniel Das which resulted in the range extension of several little known species (Das 1990). Turtle surveys were also done in Gujarat (Vyas and Patel 1990). Similar to the survey of freshwater turtles in 1983 by Moll and his associates, an all India land tortoise survey was initiated in 1986-87 by J.G.Frazier. Results of this work were published elsewhere (Frazier 1992 a,b; Frazier and Das 1994). Data on the distribution of turtles in Jammu and Kashmir is available in Duda and Sahi (1977).

Except, parts of Northeastern India, information on the distribution of chelonians in other parts of the country is known relatively well. However, ecology of the Indian turtles is poorly known. Several studies have been initiated in recent years concerning biology of the Indian turtles. Reproduction and reproductive physiology of softshell turles have been studied by Duda and Gupta (1982), Yadav (1983) and Rao (1985, 1986). A major long term study on the field ecology of riverine turtles was launched by the Wildlife Institute of India in 1983 in river Chambal. This study concentrated on the reproductive ecology of the riverine turtles especially hardshells (*Kachuga* spp.). The findings of this study are available in Rao and Singh (1987) and Rao (1991).

Similarly, ecological studies on the turtles of a semipermanent wetland was initiated by the BNHS at Keoladeo National Park, Bharatpur. This study generated information on the food habits (Bhupathy 1990,

Bhupathy and Vijayan 1993), predation (Bhupathy and Vijayan 1989) and impact of drought on the softshell turtles especially the Indian flapshell turtle, *Lissemys punctata* (Bhupathy and Vijayan 1994).

Studies on the captive breeding of Indian turtles and tortoises are scanty. An inventory on the captive stock of the Indian freshwater turtles and land tortoises is available (Choudhury and Bhupathy 1992). Considerable amount of data is available on the captive breeding of two rare and endangered turtles, namely the River terrapin (*Batagur baska*, Gosh and Mandal 1990) and Narrow-headed softshell turtle (*Chitra indica*, Bhaduria et al. 1990). Madras Crocodile Bank is in the process of developing captive breeding facilities for Indian turtles and tortoises (Das 1991a). Turtles are important source of protein and are used by Indians since centuries. Information on the exploitation of turtles and tortoises are available (Fugler 1984, Das 1990a, Moll 1991 and Choudhury and Bhupathy 1993).

Apart from Smith (1931), a few books dealing the natural history of Indian turtles and tortoises are available in recent years. They are, 1. Book of Indian Reptiles by Daniel (1983), 2. Book of Indian turtles (Das 1985) and updated Colour guide to the Turtles and Tortoises of the Indian Subcontinent by Das (1991b, 1995), and 4. Handbook: Indian Testudines by Tikader and Sharma (1985).

INDIAN FRESHWATER TURTLES AND LAND TORTOISES

The Indian subcontinent has 28 species of freshwater turtles (24) and land tortoises (4). Among them two species namely the Afghan four toed tortoise (*Testudo horsfieldi*) and Black softshell turtle (*Aspideretes nigricans*) are distributed only in Afghanistan and parts of Pakistan and, Bangladesh respectively. Hence, 26 species of freshwater turtles and land tortoises are recorded within the political boundaries of India. Indian freshwater and land chelonians belong to three families namely, *Testudinidae* (tortoises) *Trionychidae* (softshell turtle) and *Bataguridae* (hardshell turtle). The nomenclature followed herein is of Iverson (1986), (Meylan 1987) and Webb (1995). Distribution of Indian chelonians is given in Fig. 1a,b,c,d,e,f).~~{and a colour poster is attached for ready identification !! Is it required ?: B.C}~~.

TORTOISES (TESTUDINIDAE)

India has four tortoise species within the political boundaries which are grouped in three genera namely, *Geochelone, Indotestudo* and *Manouria*.

1. **Indian star tortoise (*Geochelone elegans*)**

G. elegans could be identified by the presence black and yellow coloured star marks on the carapace and plastron. Males are smaller then females and have plastral concavity. This species grows upto 38 cm in carapace length (Das 1991b).It has wide spread distribution in the arid and semiarid parts of the country occupying thorn forests. Extralimittally it is distributed in Sri Lanka and Pakistan. *Geochelone elegans* is a herbivore consuming a variety of grass and herbs. Nesting period is between May and October and

the clutch size vary from 2 to 7 eggs. This species is exploited for commercial pet trade (Choudhury and Bhupathy 1993). Also, it is eaten by indigenous people. It is listed in Schedule IV of the Indian Wildlife Protection Act (1972).

2. **Elongated tortoise (*Indotestudo elongata*)**

I. elongata grows upto 35 cm in carapace length. Overall shell colouration of this species is yellow with black blotch on each scutes. Cervical scute is present in most of the individual. It is a close relative of the Travancore tortoise (*I. forstenii*) which is endemic to the moist forests of the Western Ghats. This species is distributed in the Sal (*Shorea robusta*) forests of Northern India; Northeastern India, Gangetic plains and Northern Deccan peninsula. Very little is known about the biology of this species. It is a herbivore feeding on fallen leaves, fruits and grass. Reproductive biology of *I. elongata* is not well known. It is reported that this species undergo colour changes during the breeding season. *I. elongata* is exploited by the indigenous people of its distributional range. This tortoise is listed in Schedule IV of the Indian Wildlife Protection Act (1972).

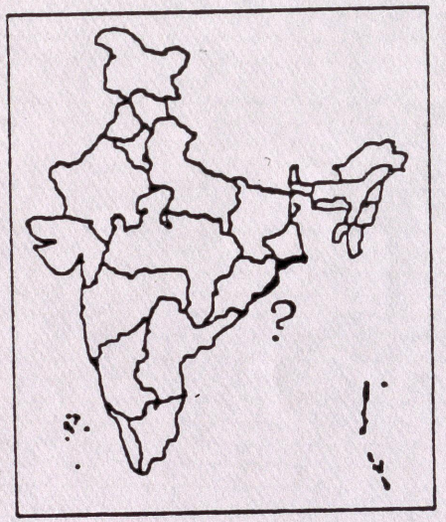
3. **Travancore tortoise (*Indotestudo forstenii*)**

I. forstenii grows upto 33.1 cm in carapace length (Das 1991b). Overall the shell colouration is yellow with a black blotch on each scutes. The cervical scute is absent in most individuals. It is a close relative of the Elongated tortoise (*I. elongata*) which is distributed in the Sal forests of Northern and Northeastern India. This species is endemic to the Western Ghats and is common in a few localities; Kothaiyar RF (Tamil Nadu); Peppara-Neyyar, Peechi-Vazhani, Parambikulam WLS (Kerala), and Neria forest, Sharavati WLS (Karnataka). The biology of this species is poorly known. It is primarily a herbivore consuming grass, fungi, bamboo shoots, fallen flowers and fruits. The breeding season of this tortoise is reported to be between November and January (Auffenberg, 1964). The same author reports that this species changes its colour during breeding season. This tortoise is being exploited for food by the native people such as *Kanis, Kadar and Malayanmar* of the Western Ghats. *I. forstenii* is listed in Schedule IV of the Indian Wildlife Protection Act (1972).

4. **Asian brown tortoise (*Manouria emys*)**

Manouria emys, the largest Asian tortoise, ranges through much of Southeast Asia. It grows upto 60 cm in carapace length. Two subspecies namely, *M. e. phayrei* (northern subspecies) and *M. e. emys* (southern subspecies) have been reported so far (Das 1991b). The subspecies differ in degree of pectoral scute contact of the plastral mid line, i.e. northern subspecies with pectoral scutes meeting in the midline of the plastron; southern subspecies with pectorals not meeting. It is suspected that both subspecies may occur within Indian limits (Bhupathy 1994). *M. emys* is distributed in the hill forests of the Northeast India and has been recorded from Nagaland, Assam and Meghalaya (Smith 1931). Natural history of this species is poorly known. *M. emys* is exploited for food by the local inhabitants. It is rare in India and is listed in Schedule IV of the Indian Wildlife Protection Act (1972).

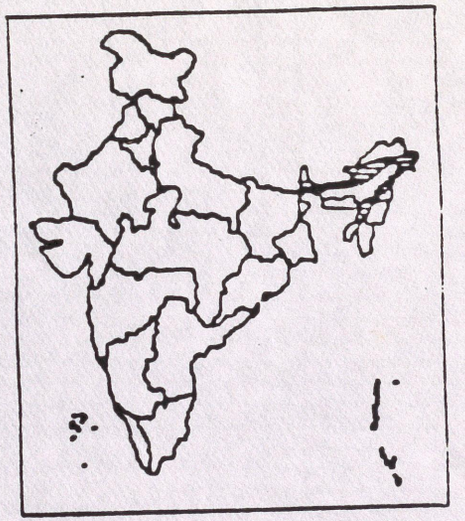
Fig. 1a Distribution of Indian Turtles



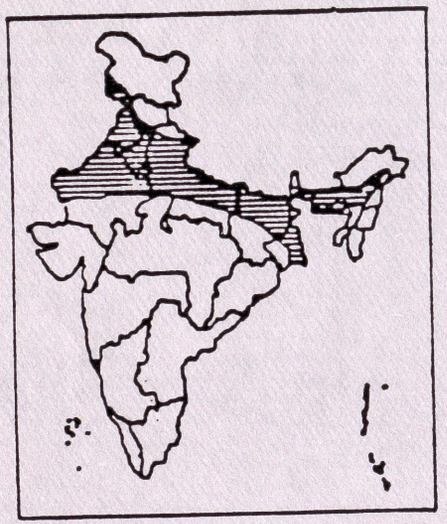
Batagur baska



Cuora amboinensis



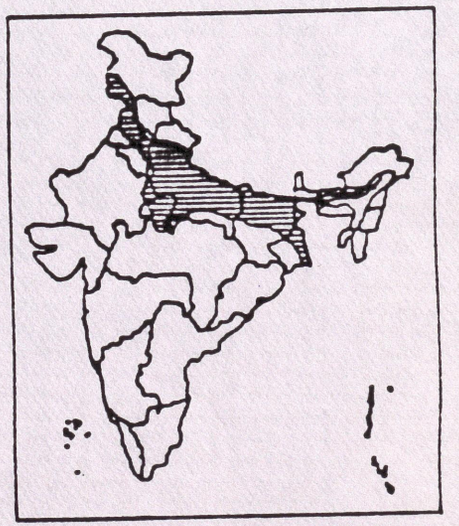
Cyclemys dentata



Geoclemys hamiltonii

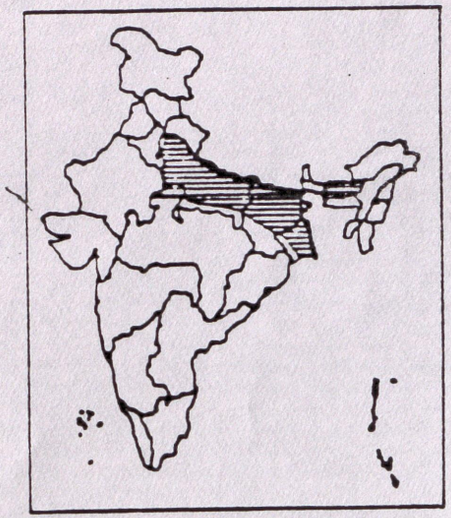


Geoemyda silvatica

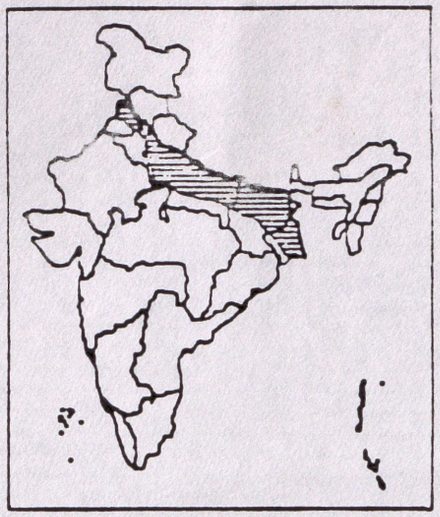


Hardella thurjii

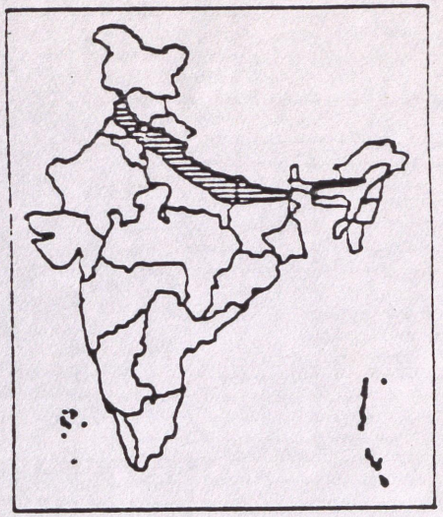
Fig. 1b Distribution of Indian Turtles



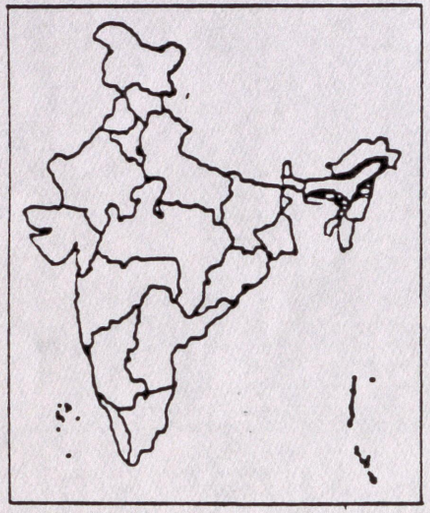
Kachuga dhongoka



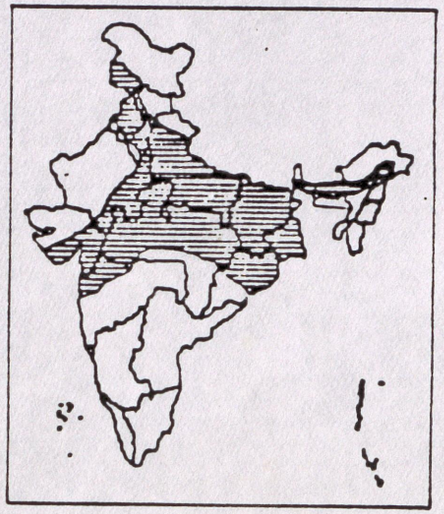
Kachuga kachuga



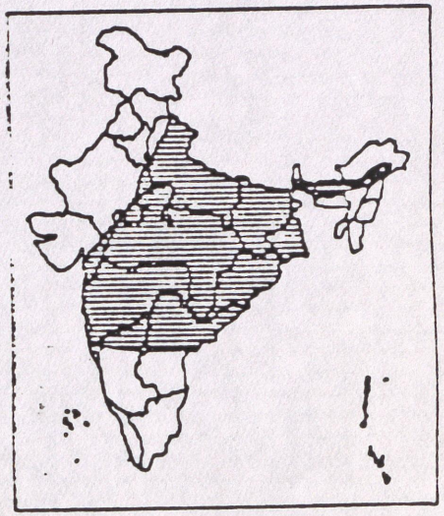
Kachuga smithii



Kachuga sylhetensis

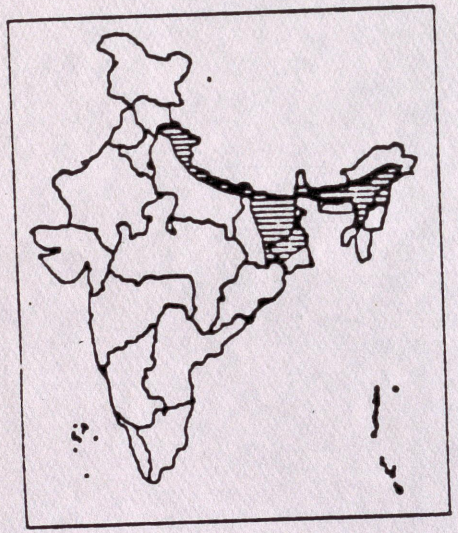


Kachuga tecta



Kachuga tentoria

Fig. 1c Distribution of Indian Turtles



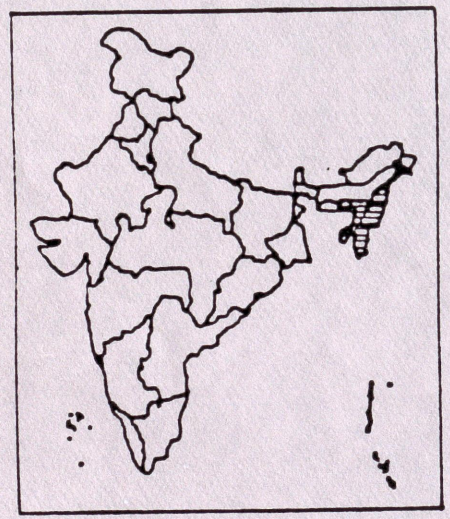
Melanochelys tricarinata



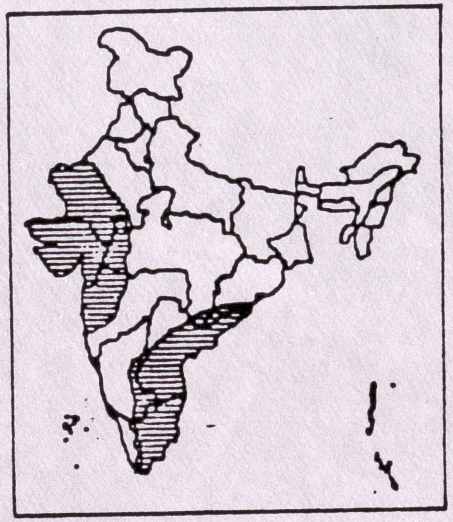
Melanochelys trijuga



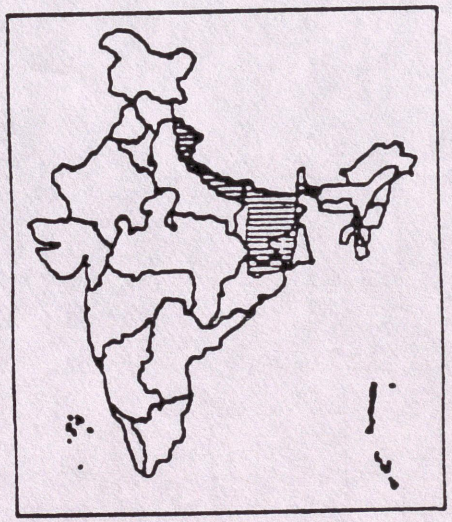
Morenia petersi



Pyxidea mouhotii



Geochelone elegans



Indotestudo elongata

Fig. 1d Distribution of Indian Turtles



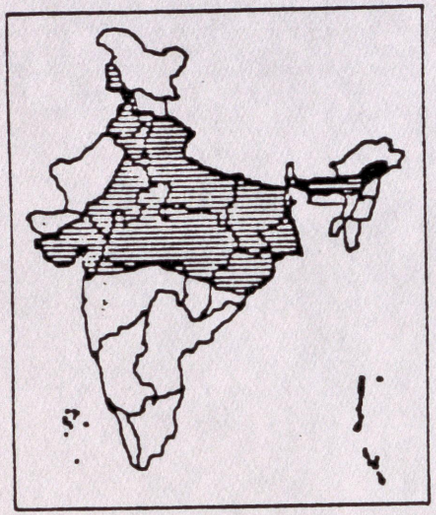
Indotestudo forstenii



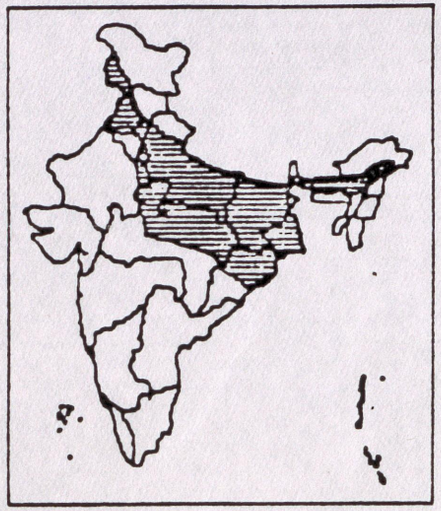
Manouria emys



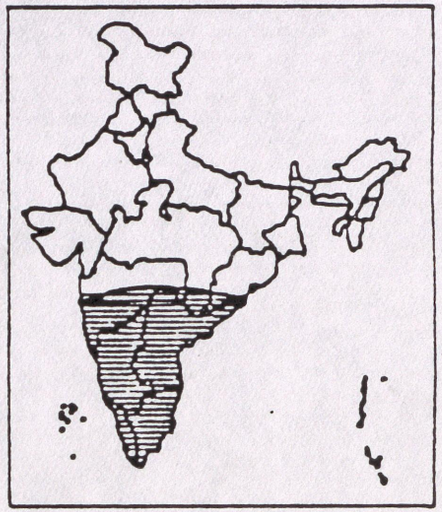
Lissemys punctata



Aspideretes gangeticus

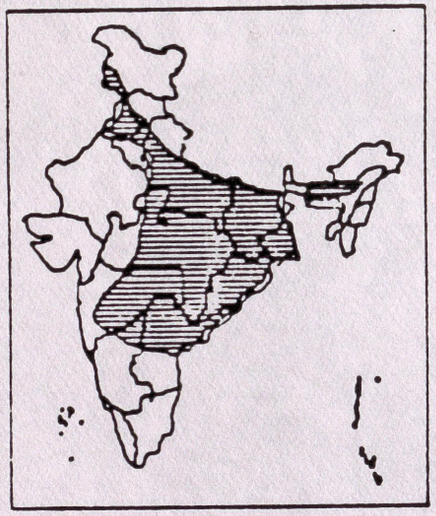


Aspideretes hurum



Aspideretes lethii

Fig. 1e Distribution of Indian Turtle



Chitra indica



Pelochelys bibroni

SOFTSHELL TURTLES (TRIONYCHIDAE)

The family Trionychidae has six species and all are widely distributed in India. Softshells are scavengers and help in cleaning the aquatic system. Indian softshells are highly utilised as food especially in the Eastern and Northeastern India.

1. **Indian softshell turtle (*Aspideretes gangeticus*)**

This species grows upto 100 cm in carapace length. The carapace is mostly olive green with black reticulations, juveniles have four to six eye like structure (ocelli) on the carapace. Head colour is green to olive green with three oblique lines behind the eyes. It inhabits rivers, reservoirs and ponds. *A. gangeticus* has wide distribution in Northern India; north of river Narmada to the foot hills of Himalayas in the north and from Gujarat in the west to Assam in the east. The distribution of this species includes four biogeographic zones, namely the Himalayas, Gangetic Plains, Semiarid and Northeast covering 11 Indian states. This is one of the commonest softshell species found in India. *A. gangeticus* is an omnivorous species consuming both plants and animals (Bhupathy 1990). Some aspects of the ecology of this species are available in Rao (1985) and (1986). The breeding season of this species is monsoon (June to November). Clutch size ranges from 20 to 40. *A. gangeticus* is highly exploited for food and is listed in Schedule I of the Indian Wildlife Protection Act (1972).

2. **Indian peacock softshell turtle (*Aspideretes hurum*)**

This aggressive large softshell turtle grows upto 60 cm in carapace length. It has black carapace, head and carapace have yellow spots and blotches. The young ones have four to six well defined ocelli on the carapace. *A. hurum* differs from *A. gangeticus* by having a darker carapace patterned with well defined ocelli, black eyes, wart-like tubercles at the posterior end of the mid dorsal line of the bony carapace and yellow spots on the head (Bhupathy and Ajithkumar 1988). *A. hurum* ranges over the Ganges and Brahmaputra flood plains covering four biogeographic zones (Semiarid, Gangetic Plains, Himalayas and Northeast India) and seven states. Till recently this species was thought to be distributed only in the lower reaches of Ganges and Brahmaputra river system (Smith 1931, Daniel 1983). However, recent surveys indicate that it is wide spread in northern India extending further west in Rajasthan and Madhya Pradesh (Bhupathy and Ajithkumar 1988, Das 1988). This omnivorous species inhabits rivers and reservoirs.It is one of the commonest turtles found in the Brahmaputra flood plains. The ecology of this species is little known. *A. hurum* nests during monsoon (July-November) and lays about 30 eggs. This is a highly exploited species especially in West Bengal and Northeast India and is protected by the Indian Wildlife Protection Act (1972) prohibiting exploitation.

3. **Leith's softshell turtle (*Aspideretes leithii*)**

A. leithii inhabits the rivers of Southern India. This large softshell has grey or olive green carapace. Young ones have three oblique streaks behind the eyes and four to six ocelli on the carapace. The anterior and

posterior parts of the mid dorsal line of the bony carapace have wart-like tubercles. *A. leithii* is endemic to the South India which has distribution south of Tapi river. This species ranges over six states (Maharastra, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala) covering two biogeographic zones; Deccan Peninsula and Western Ghats. It is common in the Godavari and Krishna rivers, however, rare in the southern part of the species distribution and in the Western Ghats. This is an omnivorous species. It breeds during the monsoon. *A. leithii* is listed in Schedule IV of the Indian Wildlife Protection Act (1972).

4. **Narrow-headed softshell turtle (*Chitra indica*)**

One of the largest freshwater turtles in Asia, *Chitra indica* grows upto 180 cm in carapace length. The carapace is flattened; olive green in colour with striking pattern. Head extremely narrow and long with eyes located closer to the nostrils. *C. indica* is wide spread in Southeast Asia and India as well ie. in India it is distributed in five biogeographic zones and in 12 states. Except for the Mahanadi river, this species is rare throughout its distribution. Recently, the Thailand populations of *C. indica* have been described as *Chitra chitra. C. indica* is carnivorous especially piscivorous in food habits. In India it nests between August and October. It has a large clutch size (65-178, Bhadauria et al. 1990). This is one of the most exploited species for food and is protected by the Indian Wildlife Protection Act (1972).

5. **Asian giant softshell turtle (*Pelochelys cantorii*)**

Indian populations of *Pelochelys* was considered as *P.bibroni* untill its redescription as *P. cantorii* by (Webb 1995). It is the largest freshwater turtle species found in Southeast Asia. The carapace is olive green or brown with or without markings. It is closely related to *Chitra indica.* This is an estuarine species having a wide distribution in Southeast Asia. In India it is distributed in the Sunderbans of West Bengal, and Coastal parts of Orissa, Tamil Nadu and Kerala. Biology of this species is poorly known. This is a carnivorous species preferring fish. Precise nesting season of this species in India is not known. It may lay 20 - 40 eggs per clutch. This species is being utilised for food through out its range. It is protected by the Indian Wildlife Protection Act (1972).

6. **Indian flapshell turtle (*Lissemys punctata*)**

Lissemys punctata, the smallest softshell species found in India, grows to 35 cm in carapace length. The carapace and head are olive green in colour. This is the only Indian softshell species having marginal bones. Two subspecies have been recognised; *L. p. punctata* (South Indian subspecies)- carapace without marking, head with three black oblique lines; *L. p. andersoni* (North Indian subspecies) - carapace and head with yellow blotches. This species utilizes variety of habitats; reservoirs, ponds, rivers and low saline estuaries. It is one of the most widely distributed species in India (ie. distribution in eight biogeographic zones and in 17 Indian states). Apart from the Western Ghats and Northeastern India, it was found to be 'common' all over India. *L. punctata* is one of the best studied chelonians of India. It is an opportunistic omnivore and scavenger (Bhupathy and Vijayan 1993). It aestivates when semipermanent water bodies disappear (Auffenburg 1981, Das 1991b, Bhupathy and Vijayan 1994).

Reproductive physiology and biology have been studied by Raghuwanshi (1975), Duda and Gupta (1982) and Yadav (1983). As with other softshells, this species nests during the rainy season (July-January). Clutch size varies from 3 to 12 and the incubation period is more than 10 months. It is one of the most exploited Indian turtle species (Choudhury and Bhupathy 1993) despite being protected by the Indian Wildlife Protection Act (1972).

HARDSHELL TURTLES (BATAGURIDAE)

The family Bataguridae (hardshell turtles) has 10 genera and 16 species in India. Hardshell turtles occupy a variety of habitats such as rivers, estuary, ponds, reservoirs, thorn and hill forests. In India, only the larger hardshells are exploited for food on commercial basis.

1. **River terrapin (*Batagur baska*)**

B. baska is one of the larger hardshell species having a carapace length upto 60 cm. The carapace is brown in colour and heavily buttressed. This species is identified by the presence of four claws in both fore and hind limbs. Males develop colouration during breeding season (black head and yellow iris). *B. baska* is wide spread through Southeast Asia (ie. Eastern India in the West to Cambodia and Vietnam in the Southeast). This species is rare throughout its range. In India it is restricted to the Sunderbans of West Bengal in recent years (Bhupathy 1997). The present day distribution of this species in the estuaries of Brahamani-Baitarani- Mahanadi rivers is doubtful. The biology of this species is not well-known. It is predominantly a herbivore preferring leaves and fruits of mangrove plants. In India it nests in February and March. The clutch size varies from 20 to 40 eggs. Early this century, *B. baska* was heavily exploited in the the Hoogly river mouth resulting in the decline of the species. *B. baska* is listed in Schedule I of the Indian Wildlife Protection Act (1972).

2. **Malayan box turtle (*Cuora amboinensis*)**

C. amboinensis may be identified by the presence of following characters; carapace brown or black, plastron yellow (black blotches may be present on the ventral side of the marginals), head brown with yellow bands and a hinge across the middle of the plastron. It grows upto 25 cm in carapace length. It is restricted to the Northeastern India especially in the grasslands and flood plains of the Brahmaputra river and is common there. This species is also found in Nicobar Islands. Biology of this species is poorly known. Nesting season of *C. amboinensis* is not known in India. This species is used as food by the inhabitants of the Northeastern India. It is not protected by the Indian Wildlife Protection Act (1972).

3. **Asian leaf turtle (*Cyclemys dentata*)**

Colour of the carapace and plastron of *C. dentata* is brown. Carapace and plastral scutes usually have black striae radiating from the areolae. The carapace is depressed with a serrated posterior margin. The upper jaw is bicuspid. *C. dentata* is wide spread in Southeast Asia. This is a little known species having known from only a few specimens from India till the present study. In India it is common in the

Northeastern India and Northern West Bengal. *C. dentata* inhabits forest streams and forest floors of semievergreen and evergreen forests. It feeds on fallen fruits, insects and land crabs. Biology of this species is poorly known and is heavily exploited for food. It is not protected by the Indian Wildlife Protection Act (1972).

4. Spotted pond turtle (*Geoclemys hamiltonii*)

Geoclemys hamiltonii grows upto 40 cm in carapace length. Carapace is black and keeled. Scutes of both carapace and plastron have radiating yellow streaks and head and neck have yellow spots. Adult males have concave plastron and longer tail. *G. hamiltonii* has a wide distribution over three biogeographic zones; Semiarid, Gangetic Plains and Northeast India. It has been recorded in seven Indian states of the Indus, Ganges and Brahmaputra flood plains. The biology of this species is poorly known. It is completely molluscivorous. The breeding season is March-June when it lays large clutches ranging from 25 to 40 eggs (Bhupathy and Choudhury 1994). It is widely used as food by the inhabitants of Northeastern India.

5. **Cochin forest cane turtle (*Geoemyda silvatica*)**

The carapace of *G. silvatica* is tricarinate and depressed. Adult males have a black carapace and yellow plastron; a black head with the forehead and posterior parts of the eyes red. Females and immatures are pale to yellow in colouration. They grow to a maximum of 15 cm. This terrestrial emydid is endemic to the Western Ghats of Kerala, Tamil Nadu and Karnataka. It is rare throughout its distribution. The biology of this species is poorly known. *G. silvatica* is active during night hours (crepuscular-nocturnal habit, Moll et al 1986). It is omnivorous, preferring fallen fruits, millipedes and snails. The species is occasionally eaten by the *Kadars, Kanis and Malayanmar* of the Western Ghats. *G. silvatica* is listed in Schedule I of the Wildlife Protection Act (1972).

6. **Crowned river turtle (*Hardella thurjii*)**

H. thurjii grows upto 61 cm in carapace length (Das 1991b). Males are significantly smaller than females which grow to a maximum of 18 cm. Major identification features are; black or brown carapace, plastral scutes bearing single large black blotch; and the head with four yellow or orange lines. This species is distributed in three biogeographic zones; the Semiarid, Gangetic Plains and Northeast covering eight Indian states, and is common on the Indus, Ganges and Brahmaputra flood plains. The biology of this species is poorly known. *H. thurjii* inhabits in the reservoirs, oxbow lakes and rivers. It is a herbivore feeding on grass and fallen fruits. It was heavily exploited for food in West Bengal until the early nineties, and is not protected by the Indian Wildlife Protection Act (1972).

7. **Three-striped roofed turtle (*Kachuga dhongoka*)**

K. dhongoka grows upto 50 cm in carapace length. Carapace brown with three black or dark brown stripes, plastron yellow without blotch and yellow line/ stripe connecting snout, eye and tympanum are identification features of this species. This species has distribution only in the Ganges system covering five states; Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar and West Bengal. It inhabits only large

rivers. Extralimittaly this species has distribution in Bangladesh. *K. dhongoka* is predominantly a herbivore. Nesting season is February to March. It has large clutch ranging from 21 to 34 eggs (Moll 1986). This is one of the heavily exploited hardshell species. However, it is not protected by the Indian Wildlife Protection Act (1972).

8. **Red-crowned roofrd turtle (*Kachuga kachuga*)**

K. kachuga attains 56 cm in carapace length (Das 1991b). Carapace brown or black and plastron yellow without blotch are identification features of this species. Males develop bright colouration during breeding season (ie. red and yellow stripes and patches on the head and neck). The distribution of this species is confirmed only in the Ganges system covering five states; Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar and West Bengal, extralimittaly in Bangladesh and probably Nepal. It inhabits only large rivers with sandy bottoms. *K. kachuga* is predominantly a herbivore. Nesting season of this species is similar to that of *K. dhongoka* ie. February and March. The clutch size ranges from 20 to 25 eggs (Moll 1986). This was one of the most heavily exploited hardshell turtle species until early nineties. It is listed in Schedule I of the Indian Wildlife Protection Act (1972).

9. **Brown roofed turtle (*Kachuga smithii*)**

This riverine species grows to 25 cm in carapace length. A low brown depressed carapace, yellow plastron (with or with out blotches) are important identification features. Two subspecies have been recognised so far; *K. smithii smithii* and *K.s. pallidipes* - yellow plastron with out marking. *K. smithii* is distributed over four biogeographic zones (Semiarid, Gangetic Plains, Himalayas and Northeast) covering six states of North India. *K. s. smithii* ranges over India, Pakistan and Bangladesh, whereas *K. s. pallidipes* occurs in the Northern tributaries of Ganges and Nepal (Moll 1987). It is an omnivore. It nests between August and November and clutch size is 3-11 (Duda and Gupta, 1982). This species is locally exploited for food, and is not protected by the Indian Wildlife Protection Act (1972).

10. **Assam roofed turtle (*Kachuga sylhetensis*)**

Steeply vaulted shell, posterior marginals serrated, 13 pairs of marginals (only 12 pairs of marginals seen in other Indian *Kachuga* spp.), carapace brown, plastral scutes with black blotches, and a yellow line behind the eyes are salient identification features of *K. sylhetensis*. It grows upto 23 cm in carapace length. *K. sylhetensis* is restricted to the hill streams of the Northeastern India. It has been recorded from Assam, Arunachal Pradesh, Nagaland and Meghalaya. Extralimittally it is known from Bangladesh. Except the incomplete distribution records of this species nothing is known about its biology. This species is exploited for food by the local inhabitants for subsistance. *K. sylhetensis* is not listed in the Indian Wildlife Protection Act (1972). This species deserves a place in this Act.

11. **Indian roofed turtle (*Kacuga tecta*)**

K. tecta has the following identification features; carapace elevated with a spike on the third vertebral, carapace brown, plastron yellow with more than one black blotches on each scutes and orange crescent

shaped post ocular marking. Males are smaller than females. This species grows upto 25 cm in carapace length. *K. tecta* is one of the commonest and widespread hardshell species distributed in North India ie. five biogeographic zones covering atleast 11 states. It is common in the Indus, Ganges, Brahmaputra, Mahanadi and Narmada river systems. Unlike other *Kachuga* spp., this species inhabits variety of habitats such as ponds, reservoirs, and rivers. It is predominantly a herbivore and non-aggressive species. It nests in winter month; January in Uttar Pradesh (Moll 1987) and its clutch size varies from 4 to 10 eggs (Duda and Gupta 1982). This small riverine hardshell turtle is exploited for food and the pet trade (Choudhury and Bhupathy 1993). *K. tecta* is listed in Schedule I of the Indian Wildlife Protection Act (1972) and hence given legal protection.

12. **Indian tent turtle (*Kachuga tentoria*)**

K. tentoria grows upto 25 cm in carapace length. The shell of this species is elevated with a spike on the third vertebral. Plastral scutes of this species are yellow with or without blotches. Three subspecies are recognised; *K. tentoria tentoria* (plastral scutes with single large black blotches, and a red post ocular spot), *K. t. circumdata* (pink pleuromarginal ring, plastral scutes with single black blotches, pink post ocular spot and ring) and *K. t. flaviventer* (plastron unpatterned, head witha pink post ocularspot). *K. tentoria* is the most wide spread *Kachuga* spp.; Krishna river in the south to Northern Uttar Pradesh in the North, Gujarat in the west to Assam and Arunachal Pradesh in the east covering atleast five biogeographic zones and 11 states in India. It is common throughout its range. It primarily inhabits rivers. *K. tentoria* is an omnivore. It nests between October and January and clutch size vary from 3 to 12 eggs (Rao and Singh 1987). This species is exploited for food and the pet trade. *K. tentoria* is not protected by the Indian Wildlife Protection Act (1972).

13. **Tricarinate hill turtle (*Melanochelys tricarinata*)**

M. tricarinata grows upto 18 cm in carapace length. Black or dark brown carapace with three yellow keels (ie. tricarinate), plastron yellow with out markings and head brown with orange line or streak behind the eyes are identification features of this species. It inhabits the Northeast India, Gangetic Plains and Himalayan biogeographic zones. *M. tricarinata* is common in Northeast India, Northern West Bengal, and Uttar Pradesh. Little is known on the biology of this species. It prefers the wet grasslands and hill forests of the Northeastern India and Himalayan foot hills. It is an omnivore feeding on insects, seeds and fruits. This species is exploited by the tribals of Northeastern India. *M. tricarinata* is protected by the Indian Wildlife Protection Act (1972).

14. **Indian black turtle (*Melanochelys trijuga*)**

M. trijuga grows upto 38 in carapace length. The shell is black without notable markings. Based on head colorations seven subspecies were recognised; *M. trijuga trijuga, M. t. thermalis, M. t. coronata, M. t. indopenisularis, M. t. edeniana* and *M. t. wiroti.* This species is widely distributed over seven biogeographic zones and atleast in 11states. It inhabits a variety of habitats; rivers, reservoir, ponds, wet grasslands and hill forests. Even though this species is abundant in many localities, the biology of this species is poorly

known. *M. trijuga* is omnivorous. It nests during July - November and the clutch size vary from 1 to 5 eggs. This species is locally exploited for food, and is not protected by the Indian Wildlife Protection Act (1972).

15. **Indian eyed turtle (*Morenia petersi*)**

Dignostic features of *M. petersi* includes a black or dark green carapace, scutes patterned with yellow ocelli, an unmarked yellow plastron, and head marked with yellow stripes. It grows upto to 20 cm in carapace length. The is species has a restricted distribution; ie. parts of Northern and eastern Ganges and Western Brahmaputra (Smith 1931, Moll and Vijaya 1986). It also occurs in the Indian Sunderbans. The distribution and biology of this species is poorly known. It is reported to inhabit rivers (Khan 1982, Fugler, 1984). Moll and Vijaya (1986) found the turtle in weed choked nullahs and an oxbow lake. It is not protected by the Indian Wildlife Protection Act (1972).

16. **Keeled box turtle (*Pyxidea mouhotii*)**

P. mouhotii is a terrestrial emydid (carapace length 18 cm) with a markedly flattened yellow carapace. It has restricted distribution in India (ie.only in two biogeographic zones Himalayas and Northeast) Biology of this species is not well known. It is not protected by the Indian Wildlife Protection Act (1972).

CHAPTER II

WII-USFWLS FRESHWATER TURTLE AND LAND TOROTISE CONSERVATION PROJECT

The relationship between Indians and turtles goes back many centuries. This is reflected by the place it occupies in Indian mythology (ie. regarded as the incarnation of god *'Vishnu'*). Turtles, both freshwater and land species, have been exploited throughout their range in India for food and medicine. As a source of protein for fishermen, tribals and others, it is an important renewable resource. They play an important role as scavengers in aquatic ecosystems, many softshell turtles being carrion eaters. Turtles mostly feed on dead, injured or diseased animals instead of healthy ones. By removing unhealthy ones from the ecosystem, turtles help in maintaining a healthy community of organisams. While the carnivorous species also feed on snails and insects that spread diseases to humans and livestock, the herbivorous turtles feed on aquatic weeds and land tortoises feed on poor quality scrub-land forage unsuitable for livestock converting this less valued fodder into protein rich biomass, available to higher trophic levels including humans (Moll 1991). The level of commercial exploitation is a cause of worry for the survival of several turtle species. Increasing destruction and shrinkage of their habitat combined with direct exploitation is a major threat to the Indian freshwater turtles and land tortoises.

India has one of the most diverse assemblages of non-marine chelonians in Asia with 26 species(ie. 22 freshwater turtles and four land tortoises). Freshwater turtles and land tortoises in particular are long ignored group of animals in India. Much of our knowledge of this assemblage comes from writings of the British naturalists, especially Malcolm Smith's 1931 treatise on Indian chelonians in the *Fauna of British India*. Following Smith's commendable work, scientific interest in Indian chelonians lagged for the next fifty years.

Research on Indian chelonians gained momentum again in early eighties. The International Union for Conservation of Nature and Natural Resources (IUCN)/ Species Survival Commission (SSC) on the Freshwater Chelonian Specialist Group (FWCSG) and Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) met in New Delhi in February 1981 to plan conservation action for Indian chelonians. This meeting resulted in the initiation of a one year survey on freshwater turtles conducted by E.O. Moll (1981-82). Apart from providing valuable information regarding the distribution and ecology of Indian turtles in general, it created interest and awareness in many Indian youths and scholars. It also resulted in several recommendations concerning establishing sanctuaries, captive breeding programmes and a proposal for inclusion of additional freshwater turtles in the Schedules of the Indian Wildlife Protection Act (1972) for proper protection and conservation. Based on these recommendations, 16 species were listed in the Schedules of the Wildlife Protection Act 1972. The updated Red Data Book (1988) included 10 species in the listing and the CITES listed 10 species in the Appendix I (Stubbs 1991).

The 1982 freshwater turtle survey by Moll and his associates J. Vijaya and Satish Bhaskar recommended captive breeding programmes for certain hardshells and some commercially exploited softshell turtles.

However, quantitative information on the status, habitat condition, and exploitation pressure on the Indian freshwater turtles and tortoises were meagre. A turtle survey; both field and current literature survey conducted between June 1986 and September 1987 revealed as many as 47 range extensions or new locality records (Frazier 1992a). This indicated that any attempt to develop a conservation Action Plan for Indian chelonians with out basic information such as status, distribution and some aspects of biology will be futile. It is to be noted that the status of many turtle species especially those distributed in the Northeast India and Western Ghats, South India were least known and hence, a survey gained top priority.

This prompted the Indian scientists and IUCN/SSC Freshwater Chelonian Specialist Group members especially, the U.S. Scientists to initiate a study. Under the aegis of the Indo-US Sub-Commission on Science and Technology, the Ministry of Environment and Forests, Government of India asked the Wildlife Institute of India (WII), Dehra Dun to undertake a project on Freshwater Turtles and Land Tortoises Conservation and Management in collaboration with the United States Fish and Wildlife Service (USFWLS) in September 1990.

The three year WII-USFWLS collaborative Project on the Conservation and Management of Freshwater Turtles and Land Tortoises in India was launched in May 1991. The initial emphasis of the project was on developing *ex-situ* conservation programmes for some of the rare and endangered chelonian species of India. However, it was felt that in the absence of reliable reports on the status of turtles and their habitats, it would not be possible to play proper conservation and management actions. Hence, emphasis was given to status surveys and collection of information on habitat and exploitation. Also, an inventory on captive stock of freshwater turtles and land tortoise was conducted to help in the captive breeding of certain species of chelonians if required avoiding further pressure on wild populations.

The present project had the following objectives:
(1) to determine the current status of tortoises and freshwater turtles in India,
(2) to identify viable turtle populations and suitable habitats to establish protected areas for protection and conservation,
(3) to set up captive breeding programmes for endangered turtles and tortoises aimed at reintroduction, and
(4) to provide scientific information and training to biologists and managers on turtle biology, conservation and management methods.

Following the initiation of this project in May 1991, data on the current status, exploitation and captive breeding of turtles were collected by questionnaire surveys and active field work. Field surveys included all but two biogeographic zones namely Himalayas, Indian Desert, Semiarid, Western Ghats, Deccan Peninsula, Gangetic Plains, Northeast India and Coast. A detailed analyses was done on the status of the freshwater turtles and tortoises at biogeographic and state levels and action plans proposed. Based on this, a new status listing is proposed for turtles and tortoises to incorporate in the Indian Wildlife

Protection Act (1972). A list of papers or reports submitted or published based on the work of this project is given in Appendix II.

A workshop on Freshwater Turtles and Land Tortoises Conservation Research and Management was conducted at Gwalior and the National Chambal Sanctuary, Madhya Pradesh during 10-13 March 1993 to disseminate the information gathered during the present study.

CHAPTER III

STATUS AND DISTRIBUTION OF INDIAN FRESHWATER TURTLES AND LAND TORTOISES IN VARIOUS BIOGEOGRAPHIC ZONES

METHODS

The Turtle Conservation Project was initiated in May and till August 1991, secondary information was collected on the turtle distribution by literature survey and a request for information through print media such as the Hornbill (News Letter of the Bombay Natural History Society), BNHS member's circular, Hamadryad (Herpetological Journal from Madras Crocodile Bank Trust) and Zoos' Print (Monthly magazine of the Zoo Outreach Organisation, Coimbatore). Also, questionnaires were sent to Protected Area (PA, ie. Sanctuaries, National Parks) managers and wildlife researchers all over the country. To define the distribution of rare and endangered turtles and tortoises in India, the National Museum, Zoological Survey of India (ZSI), Calcutta and the Bombay Natural History Society Museum (BNHS), Mumbai were visited and specimens examined **(Appendix III)**. This was useful in the selection of further field survey sites.

Rodgers and Panwar (1988) classifed India into ten biogeographic zones (**Fig. 2**) based on fauna and floral distribution. Eight biogeogrophic zones were shortlisted for the present survey of turtles and tortoises, they were; 1) Himalayas 2) Indian Desert 3) Semiarid 4) Western Ghats 5) Deccan Peninsula 6) Gangetic Plains, 7) Northeastern India and 8) Coastal Zone. Two zones namely the Trans-himalayas and Islands were omitted from the present study as the Indian Trans-himalayas had no turtle reports and Islands especially the Andaman and Nicobars have only one native species. Atleast 10% of the Protected Areas (PA) of the country and a considerable number of locations outside the PA were identified to be surveyed **(Table 1)**. A total of 62 localities including 45 PA (**Appendix IV**).

Table 1. Biogeographic representation of survey localities.

Biogeographic zone *	No. of protected areas		Remarks
	Available	Surveyed	
1. Trans-himalayas	2	-	Turtle species absent
2. Himalayas	66	6	
3. Indian Desert	4	2	1 outside PA
4. Semiarid	63	7	2 outside PA
5. Western Ghats	47	13	2 outside PA
6. Deccan Peninsula	118	16	4 outside PA
7. Gangetic Plains	34	11	5 outside PA
8. Coast	22	3	
9. Northeast India	33	4	1 outside PA
10. Islands	100	-	

* based on Rodgers and Panwar (1988)

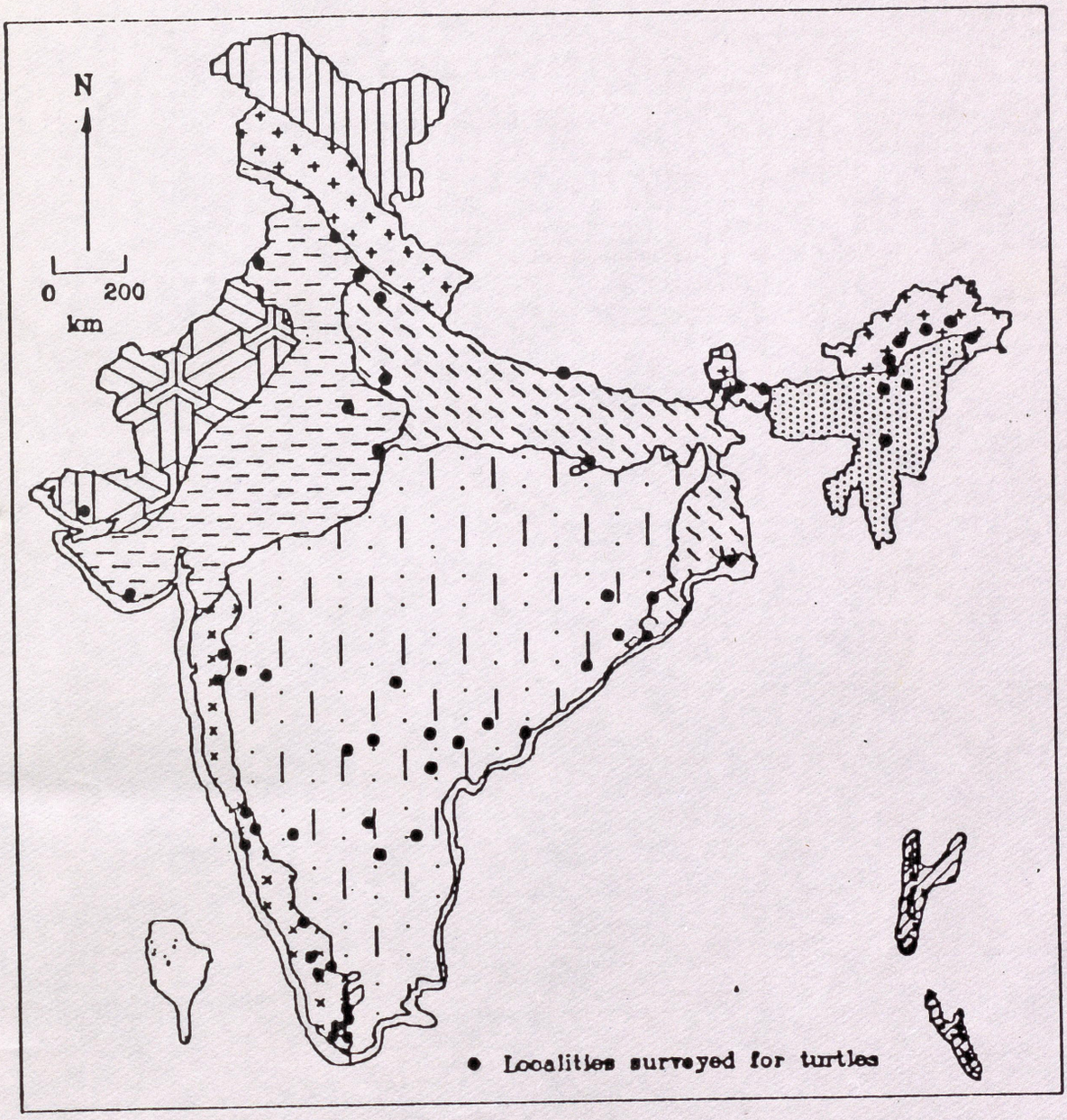


Fig. 2. Biogeographic zones of India

Trans-himalaya

Himalaya

Desert

Semi-Arid

Western Ghats

Deccan Peninsula

Gangetic Plain

Coast

North-east

Islands

Assistance of local herpetologists as Local Resource Persons were availed for each field survey depending on their availability and/or knowledge (**Appendix V**). Survey methods included actual searching (time and area constrained) in the probable habitats, inquiring in forest villages and tribal settlements and checking in fish and meat markets wherever possible. Habits and habitats of the turtle species were considered for the selection of sampling techniques for the survey. For example, softshell turtles have the habit of burying themselves in the soft mud and hence, a probing technique was used to locate them. Similarly, hardshell turtles bask extenively and in this case, basking turtles (species and number) were counted. Nets and traps were used whereever applicable to sample ponds, reservoirs and rivers for freshwater turtles. Intensive searches were conducted using local inhabitants especially, experienced trackers to locate land tortoises and forest dwelling emydids. Survey methods adopted in the present study are given in the form of a schematic diagram (**Fig. 3**).

RESULTS AND DISCUSSION

I. TRANS-HIMALAYAS

No turtle species inhabits the Indian part of Trans-Himalayas and hence it was not surveyed.

II. HIMALAYAS

Sixty- six protected areas have been identified in this zone by Rodgers and Panwar (1988) and six localities were surveyed **(Fig. 4)**. Thirteen species of freshwater turtles and land tortoises were recorded in this biogeographic zone during the present survey **(Table 2)**. Two speceies namely *Hardella thurjii* and *Kachuga smithii* may be present in the rivers of Himalayan foot hills especially in the rivers and reservoirs of Buxa Tiger Reserve (TR). Information on range extensions of a few rare and little known chelonians of the Himalaya biogeographic zone is given below:

1. **Malayan box turtle (*Cuora amboinensis*)**

C. amboinensis has a wide distributuion in Southeast Asia. In India it inhabits marshy grasslands. During the present survey, it was located only in D'Ering Wildlife Sanctuary (4 shells), Arunachal Pradesh in this biogeographic zone. D'Ering Wildlife Sanctuary (WLS) is a marshy grasslands in the Brahmaputra flood plains located in the foot hills of Himalayas. This is the first record of this species in Arunachal Pradesh.

2. **Asian leaf turtle (*Cyclemys dentata*)**

C. dentata is a semiaquatic turtle with a wide distribution in Southeast Asia. This species was recorded in the Pakhui WLS (1 live turtle, 5 shells), Chessa Reserve Forest (RF) adjacent to Itanagar WLS (1 live turtle), nearby D'Ering WLS (1 shell), Namdapha TR (4 live, 1 shell) and in Buxa TR (1 live and 2 shells).

Most of the specimens were obtained from forest camps and tribal settlements in evergreen forest tracts of the PA. Records of this species in this zone are scanty. The present observations show that this species is common in the Himalayan foothills of Northeastern India.

Table 2. Turtle species recorded in the Himalaya Biogeographic Zone

No.	Species	Locality surveyed					
		Buxa NP/WLS	Namdapha NP	D'Ering WLS	Itanagar WLS	Mehao WLS	Pakhui WLS
1	*Cuora amboinensis*			4			
2	*Cyclemys dentata*	3	5	1	1		6
3	*Hardella thurjii* *						
4	*Kachuga smithii**						
5	*K. sylhetensis*				?		7
6	*K. tecta*						
7	*K. tentoria*			3			
8	*Melanochelys tricarinata*	3					
9	*M. trijuga*	2					
10	*Pyxidea mouhotii*		5			1	
11	*Indotestudo elongata*	8					
12	*Aspideretes gangeticus*	1 ?		?	?		?
13	*A.hurum*	1?	2	1	?	2	?
14	*Chitra indica*						
15	*Lissemys punctata*	2					

Note: ? Broken shells collected to be confirmed , * Distribution suspected

3. **Assam roofed turtle (*Kachuga sylhetensis*)**

K. sylhetensis is a little known species found in the Northeastern states of India and Bangladesh. It inhabits flowing streams of the hill forests. Four shells and three live turtles of *K. sylhetensis* were recorded in the Pakhui WLS in Arunachal Pradesh. The occurrence of this turtle in Pakhui WLS was not reported earlier. Many locals reported the occurrence of this species in Itanagar WLS. Also, this species may be present in Mehao WLS and Namdapha TR as suitable habitats such as flowing streams in evergreen and semi evergreen forests are found.

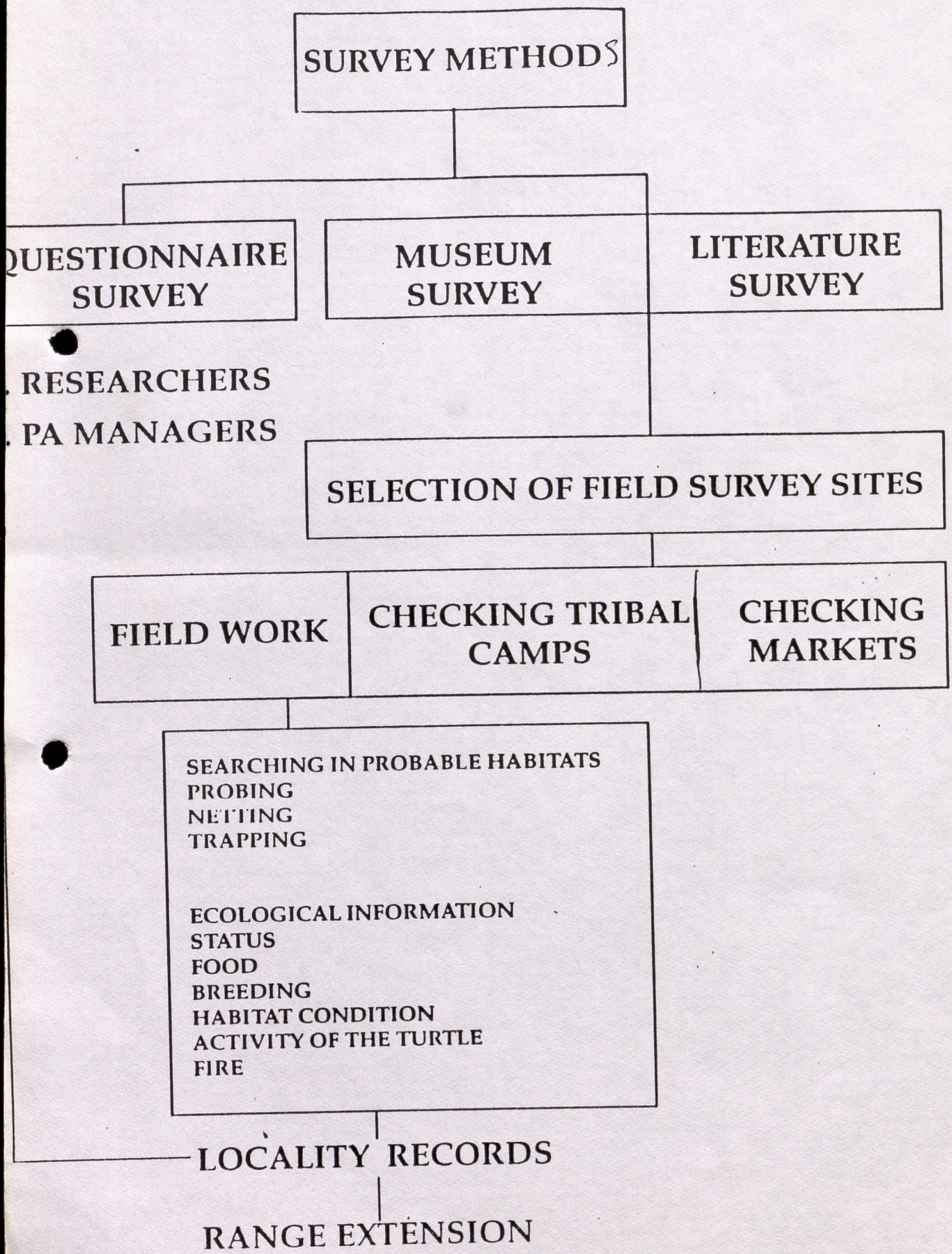
4. **Tricarinate hill turtle (*Melanochelys tricarinata*)**

Distributed in Northerneastern India and Northern Gangetic Plains, *M. tricarinata* inhabits wet grasslands and hill forests. During the present survey this species was recorded in the Buxa TR and it appears to be common there.

5. **Keeled box turtle (*Pyxidea mouhotii*)**

P. Mouhotii was recorded in the Namdapha TR (three live from Namdapha Zoo and two shells from forest camp) and Mehao WLS (one shell) in Arunachal Pradesh. The presence of this species in Namdapha TR had been reported earlier. However, the record in Mehao WLS is an extension of the range of this species. All records of this species were in evergreen forests.

Fig. 3. Schematic diagram : Survey methods



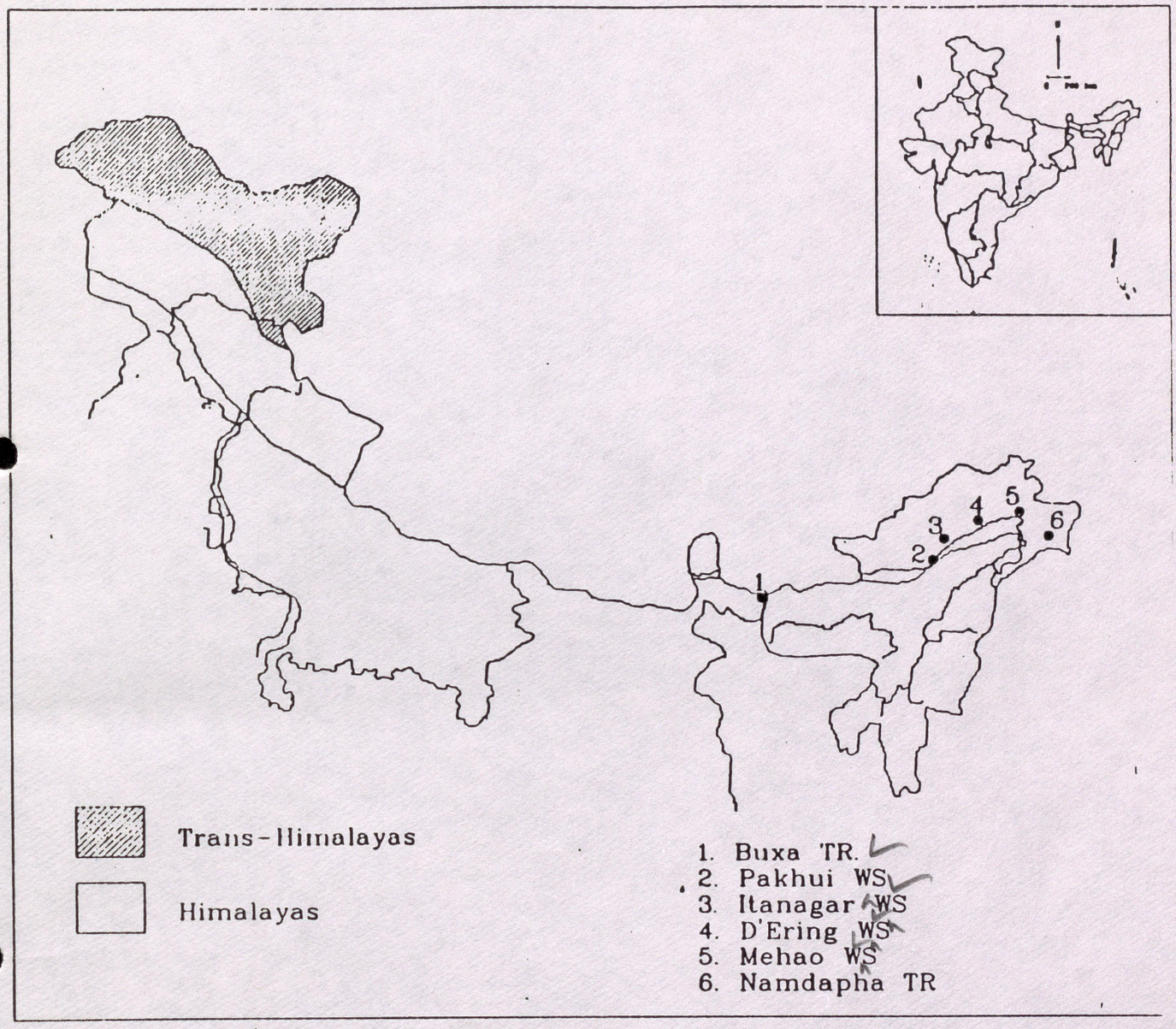


Fig. 4 Himalayan biogeographic zone showing survey localities.

6.**Indian peacock softshell turtle (*Aspideretes hurum*)**

A. hurum is widely distributed in Northeastern India and was found in the following PA: D'Ering WLS (1 live), Mehao WLS (2 shells), one live specimen in Miao Zoo and two shells in the museum of Miao Zoo (Namdapha TR). This species was not recorded from Arunachal Pradesh before and is a significant range extension. The Miao Zoo specimens were said to have been collected from the Diyun River near the Myanmar border. Hence, the occurrence of this species in Myanmar is also possible. It has been recorded in the past from both stagnant waterbodies and rivers as in the present survey. Presence of this species in Buxa TR in West Bengal, Itanagar WLS and Pakhui WLS in Arunachal Pradesh is to be confirmed as these PA have suitable habitats such as vegetated stagnant waterbodies.

III. **Indian Desert**

This biogeographic zone has four PA; the Kachchh Desert WLS, Wild Ass WLS, Narayan Sarovar WLS in Gujarat and Desert WLS in Rajasthan (Rodgers and Panwar 1988). One PA (Wild Ass WLS) and one locality outside PA (Bhuj) were surveyed (**Fig. 5)**. One species of freshwater turtle, *Lissemys punctata* and one land tortoise, *Geochelone elegans* were recorded during the present survey **(Table 3)**. Both species were common. Apart from this, two additional species, the Indian softshell turtle (*Aspideretes gangeticus)* and Spotted pond turtle (*Geoclemys hamiltonii)* are reported to occur in the arid parts of Rajasthan and Gujarat (I.Prakash Pers. Comm.) but this was not confirmed during the present survey.

Table 3. Status of chelonians in the Indian Desert

No.	Species	Locality surveyed	
		Wild Ass WLS	Bhuj (Kachchh)
1	*Geoclemys hamiltonii* *		
2	*Aspideretes gangeticus* *		
3	*Geochelone elegans*	3	1
4	Lissemys punctata	7	1

* Reported in the arid zone of Rajasthan and Gujarat, to be confirmed.

IV. SEMIARID ZONE

Sixty three PA have been identified in the Semiarid biogeographic zone by Rodgers and Panwar (1988). Seven localities were surveyed in this zone which include five protected and two unprotected areas **(Fig. 5)**. Twelve species of freshwater turtles and one species of land tortoise were recorded (**Table 4**). Among them *Lissemys punctata* and *Aspideretes gangeticus* were common and widely distributed. *Geochelone elegans, Kachuga tecta* and *K.tentoria* were locally common in one or two surveyed localities. Higher species richness in this zone is largely due to the neighbouring Gangetic Plains which impact on the eastern parts of this zone. Also, it is due to the Chambal river and Indus system rivers namely, Beas and Satlej which flow through this biogeographic zone. The record of *Melanochelys trijuga* in Simbalbara WLS,

Himachal Pradesh is the northwestern most distribution of this species. The greatest concentrations of turtle species and numbers were recorded in Keoladeo NP, Bharatpur, Rajasthan; Harike WLS, Punjab and in Tristate National Chambal Sanctuary **(Table 4).**

Table 4. Turtle fauna of Semiarid Biogeographic Zone

No.	Species	Locality surveyed						
		Harike WLS	Simbalbara WLS	Gir WLS	Tapi river	Bharuch	Chambal WLS #	Keoladeo NP*
1	*Geoclemys hamiltonii*	18						12
2	*Hardella thurjii*	8					1	499
3	Kachuga dhongoka						24	
4	*K. kachuga*						3	
5	K. smithii	36						
6	K. tecta	6						39
7	*K. tentoria*						40	1
8	*Melanochelys trijuga*		2					
9	*Geochelone elegans*			12		31		
10	*.Aspideretes gangeticus*	1			4		12	174
11	*.A.hurum*							6
12	*Chitra indica*	1					2	
13	*Lissemys punctata*	8		5	3	2	4	1074

* Bhupathy and Vijayan 1991, # Sum of two surveys (in May 1991 and March 1993)

V. WESTERN GHATS

The Western Ghats biogeographic zone consists of 47 PA which are distributed in the states of Kerala, Tamil Nadu, Karnataka and Maharashtra. Eleven PA were surveyed (ie. one in Karnataka, four in Tamil Nadu, four in Kerala and two in Maharashtra. Also, two unprotected forests namely Neria Estate, Karnataka and Kothaiyar Reserve Forest (RF) in Tamil Nadu were surveyed **(Fig. 6)**. The main objective of this survey was to collect information on the status and distribution of two rare and endemic chelonians; *Geoemyda silvatica* and *Indotestudo forstenii.*

Six chelonian species namely; *Aspideretes leithii*, *Lissemys punctata*, *Melanochelys trijuga*,*Geoemyda silvatica*, *Indotestudo forstenii* and *Geochelone elegans* were recorded during this survey **(Table 5)**. *A. leithii, L. punctata* and *G. elegans* were recorded from only one site; Sharavati, Peechi-Vazhani and Mudumalai WLS respectively. The presence of *G. elegans* in Nilgiri District, Tamil Nadu (Mudumalai WLS, 800 MSL) was not reported earlier. Information on the rare and endemic chelonians of the Western Ghats is given below:

1. **Cochin forest cane turtle (*Geoemyda silvatica*)**

G. silvatica is a forest dwelling emydid, endemic to the Western Ghats. This species was recorded in five localities during the field surveys. They were, Neyyar, Peppara, Peechi-Vazhani and Parambikulum WLS in Kerala and Indira Gandhi (formerly the Anaimalai) WLS, Tamil Nadu. Previously this species had been reported only from the Chalakudi forests, Kerala. Also, a shell collected from Neria forest by B.K.Sharath

was examined. The questionnaire survey revealed its presence in Mundanthurai WLS (Wesley Sunderraj, Pers. Comm. and photo). *G. silvatica* was observed in moist deciduous, semievergreen and evergreen forest types at elevations between 400-800 m. The survey revealed that this species is more widespread then believed. However, the forest cane turtle is rare and sparsely distributed when compared with *Indotestudo forstenii*.

2. **Travancore tortoise (*Indotestudo forstenii*)**

Indotestudo forstenii is an endemic chelonian restricted to the Western Ghats. Seven tortoises were observed in their wild habitats. Seventeen live tortoises and eight shells were found in tribal settlements in six out of 12 localities surveyed. They were Neyyar, Peppara, Peechi-Vazhani and Parambikulum WLS in Kerala, and Indira Gandhi WLS, and Kothaiyar RF, Tamil Nadu **(Table 5)**. Also, the questionnaire revealed the distribution of this species in the Neria forest, Subramanya RF and Sharavati WLS in Karnataka (B.K. Sharath, Pers. Comm. and specimens examined), and Karulai RF in Kerala (Nitin D. Rai, Pers. Comm.). In addition to these, two specimens collected from Periyar TR by the scientists of the Kerala Forest Research Institute (KFRI) and deposited in their museum were examined. The present survey revealed that this species is common in a number of localities and more wide-spread in the Western Ghats than previously known (Bhupathy and Choudhury 1995).

Table 5. Status of turtle in the Western Ghats Biogeographic Zone

No.	Species	Locality surveyed												
		1	2	3	4	5	6	7	8	9	10	11	12	13
1	*Geoemyda silvatica*				*	1			1	?	1	2	1	1
2	*Melanochelys trijuga*			6	1	2	10	1	10	2	1	1	4	1
3	*Geochelone elegans*	1					2	*						
4	*Indotestudo forstenii*			*	*	1				12	8	3	3	5
5	*Aspideretes leithii*			3			1							
6	*Lissemys punctata*	1	2										2#	

1. Sanjay Gandhi NP
2. Bhimashandar WLS
3. Sharavathi WLS
4. Neria estate
5. Indira Gandhi NP/WLS
6. Mudumalai NP
7. Kalakad WLS
8. Mundanthurai WLS
9. Kothaiyar RF
10. Neyyar WLS
11. Peppara WLS
12. Peechi-Vazhani WLS
13. Parambiculam WLS

* - reports

VI. **DECCAN PENINSULA**

Deccan Peninsula is the largest biogeographic zone of India occupying eight states; Uttar Pradesh, Bihar, Orissa, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu. It has 118 PA (Rodgers and Panwar 1988). This study surveyed 12 PA, and four unprotected areas ie. two PA in Orissa, two unprotected areas in Maharashtra, one unprotected area in Madhya Pradesh, nine PA in Andhra Pradesh and one PA and one unprotected area in Karnataka **(Fig. 7)**.

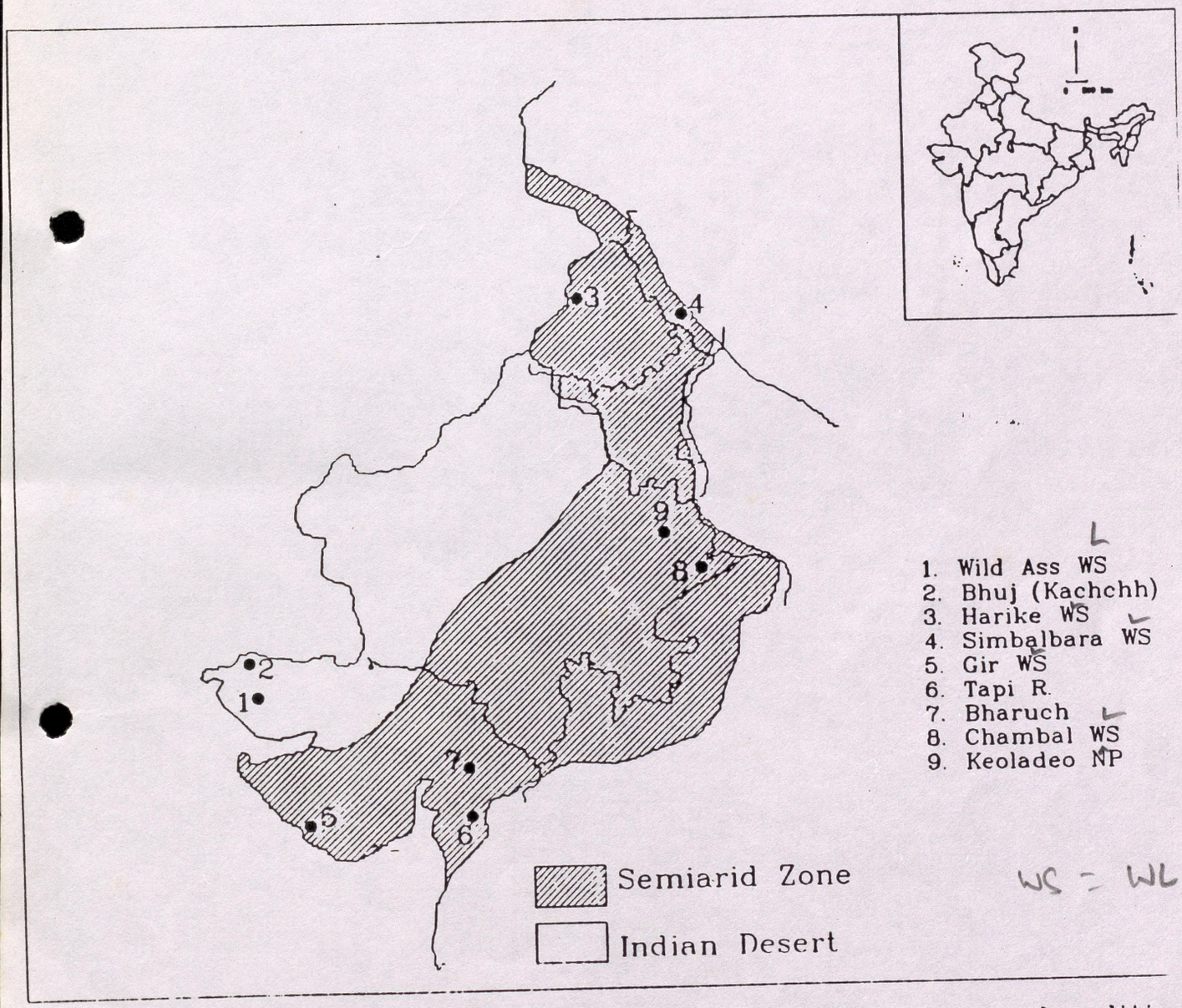


Fig.5 Indian desert and Semiarid zones showing survey localitie

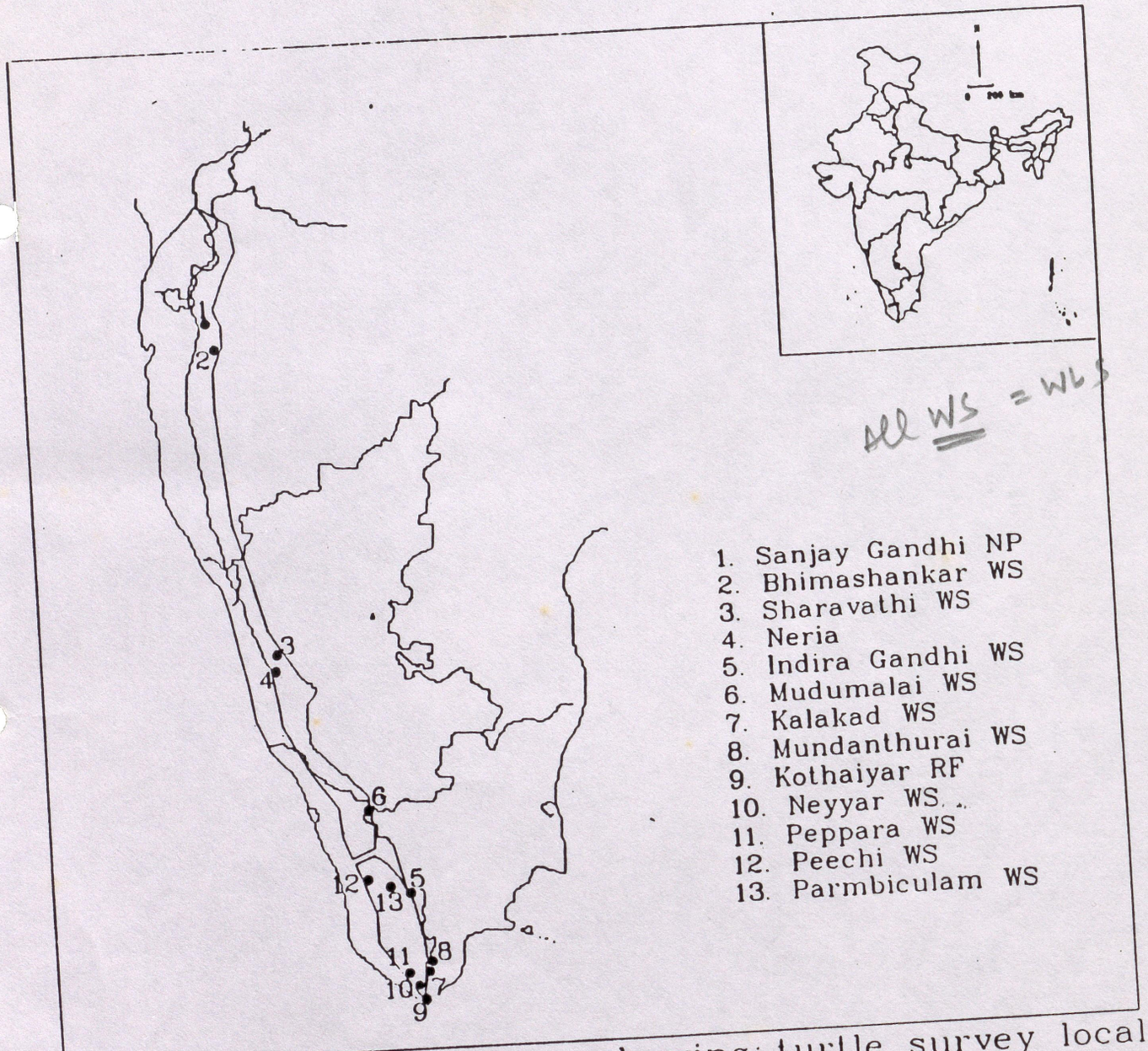


Fig.6 Western Ghats zone showing turtle survey locali

All WS Pl. change to WLS

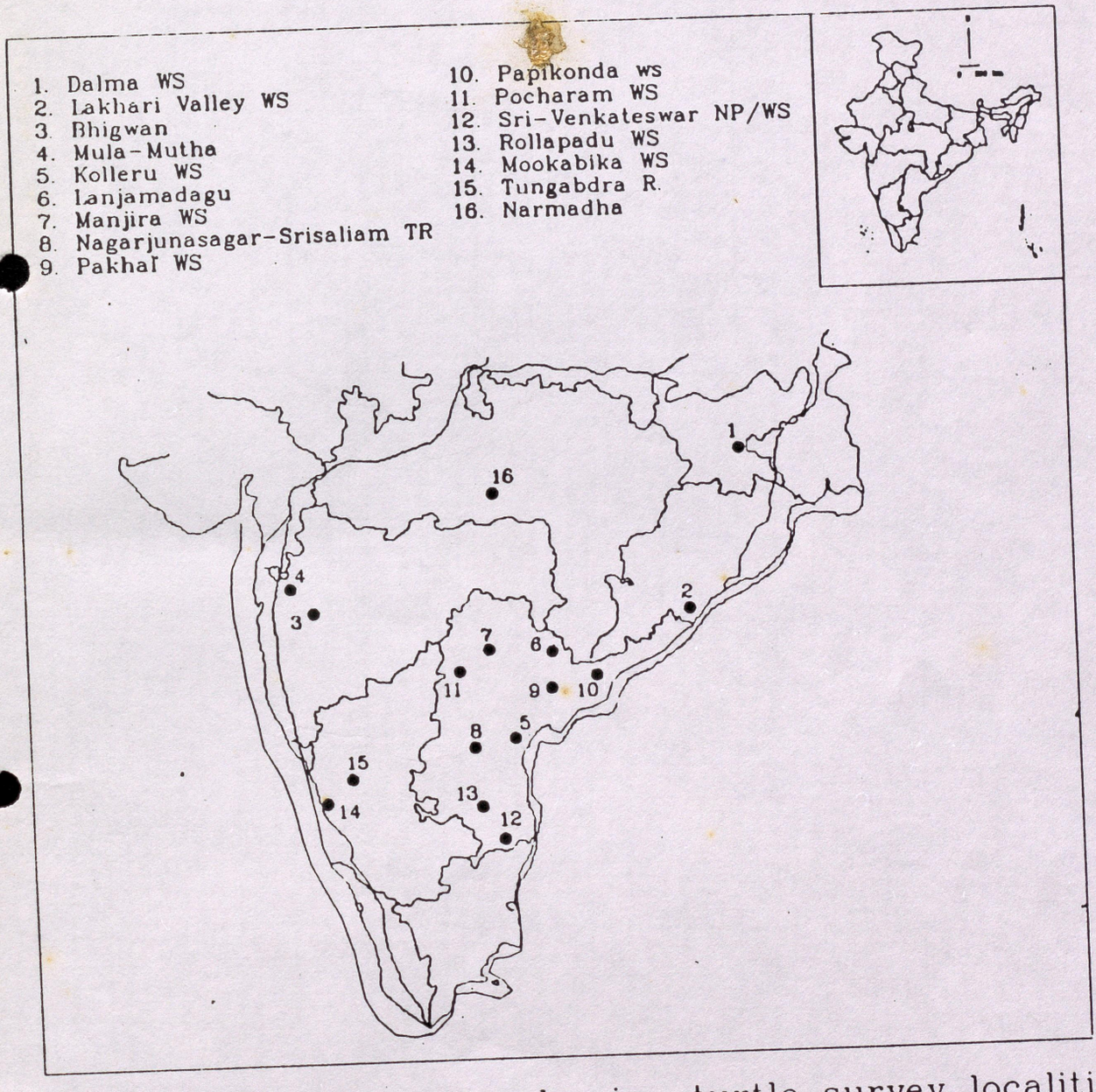


Fig.7 Deccan peninsula showing turtle survey localities

The following turtle species were recorded: (1) *Lissemys punctata* (2) *Aspideretes gangeticus* (3) *A. leithii* (4)*Chitra indica* (5) *Melanochelys trijuga* (6) *Kachuga tentoria* (7) *K. tecta* and (8) *Geochelone elegans*. *L. punctata* was recorded in all but one of the survey localities and was common. The second most common turtle species in this zone was *A. leithii* (**Table 6**). The questionnaire survey revealed the distribution of *A. leithii* in the Cauveri river near Tiruchirapali (Kalaiarasan et al 1992). Specimens of *Kachuga* were recorded only in the riverine stretches of Godhavary and Krishna.

Chitra indica was recorded in the Krishna river at Nandikotkur near the confluence of Thungabadra which is about 10 km from Rollapadu WLS, Andhra Pradesh and in Bhigwan, Puna in Bhima river, a tributary of Krishna. There are reports available of this species occurrence in Papikonda hills and Lanjanmadugu (Sivaram WLS) of the Godhavary river but could not beconfirmed during the present survey. Moll and Vijaya (1986) collected a carapace from Godhavary river at Polavaram, Andhra Pradesh which is closer to Papikonda WLS. The record of *C. indica* near Nandikotkur is the southern most record for this species in recent years and would be the first record in the main stream of the Krishna river. The Narmda river appears to be the southern most limit of the distribution of *Aspideretes gangeticus*.

Table 6. Turtle fauna of the Deccan Peninsula Biogeographic Zone

Species	Locality surveyed															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Kachuga tecta																3
2. *K.tentoria*						10	1			?						
3.*Melanochelys trijuga*											1	3	1	4		
4.*Geochelone elegans*		1				?		?	1	?	?	17			1	
5.*Aspideretes gangeticus*																1
6.*A.leithii*			2	3		1	3		1	8			1		1	
7.*Chitra indica*			2			?				?			1			
8. *Lissemys punctata*	2	2	2	2	3	4	8	8	7	1	18	1	2		1	3

Locality surveyed:

1.Dalma WLS
2.Lakhari Valley WLS
3.Bhigwan, Pune
4.Mula-Mutha, Pune
5.Kolleru WLS
6.Lanjamadagu WLS
7. Manjira WLS
8.Nagarjunasagar-Srisailam TR
9.Pakhal WLS
10.Papikonda WLS
11.Pocharam WLS
12.Sri-Venkateswar NP/WLS
13. Rollapadu WLS & Vicinity (Krishna R)
14. Mookambika WLS
15.Thungabandra River, Shimoga
16.Narmada River (M.P)

VII. **Gangetic Plains**

The Gangetic Plains is one of the largest biogeographic zones of India covering Uttar Pradesh, Bihar, Orissa and West Bengal. Thirty four PA have been identified in this zone by Rodgers and Panwar (1988). Eleven localities were surveyed in the present study of which nine were PA and the remaining unprotected

areas **(Fig. 8)**. In the present survey major emphasis was given to the south eastern (Orissa and Bihar) and northeastern (West Bengal) portion of this zone as they lack surveys in recent years. Uttar Pradesh and Bihar Gangetic Plains were surveyed extensively for turtles by Moll (1986, 1987, 1991) and Moll and Vijaya (1986) in recent years and hence not given priority in the present study. The following localities were covered during the present survey: Corbett, Rajaji NP, Narora (Ganges) in Uttar Pradesh; Valmik NP/WLS, Saranda RF, Kabar jheel, Ganges near Begusarai in Bihar; Mahanadi near Cuttack in Orissa; Gorumara, Jaldapara and Mahananda WLS in West Bengal. Sixteen species of chelonians have been recorded in this biogeographic zone **(Table 7)**. Highest number of turtle species (15) was recorded in the northern parts of this zone. Information on the rare turtle species is given below:

1. **Elongated tortoise (*Indotestudo elongata*)**

Indotestudo elongata was recorded in almost all of its previously known distribution range from this zone: (1) two live specimens and a shell in the Saranda RF, Chaibassa, Bihar (2) one live tortoise collected from Simlipal TR, Orissa (currently with Nandankanan Zoological Park, Acharjio, Pers. Comm.) (3) one shell in Gorumara WLS and (4) two shells in Jaldapara WLS, West Bengal. Also, the questionnaire survey revealed the continued existance of this species in Rajaji NP (Wesley Sunderraj, Pers. Comm., Photo) and Corbett TR (Negi, Pers. Comm.). In addition to this, during the present survey local inhabitants of Valmik TR and Mahananda WLS reported the occurrence of *Indotestudo elongata* in these PA but this could not be confirmed. The tortoise may also occur in Bhutan as they have been recorded in Gorumara and Jaldapara WLS bordering this country.

2**. Asian leaf turtle (*Cyclemys dentata*)**

Cyclemys dendata prefers small streams and the forest floor of the semievergreen and evergreen forests. It is known from only a few museum records. *Cyclemys dentata* was recorded in all localities surveyed in the Northern West Bengal during the present survey and appears to be common there (**Table 7**). Records of this species in Jaldapara and Gorumara WLS are additional localities for this species. The occurrence of *C. dentata* in Mahanada WLS suggests that it may also occur in Sikkim and Nepal.

3**. Tricarinate hill turtle (*Melanochelys tricarinata*)**

Melanochelys tricarinata is one of the terrestrial emydids distributed in north and northeastern India. During the present survey this species was recorded in many parts of the upper Gangetic Plains; in Jaldapara WLS, Valmik TR, Corbett TR, Dudwa NP (Javid and Hanfi 1995) and Doon valley. Dehra Dun appears to be the western most distribution of this species and it is common in Sal forest. *M. tricarinata* may also occur in Bhutan as this species have been recorded in Gorumara and Jaldapara WLS bordering this country.

Two large hardshell turtles; *Kachuga kachuga* and *K. dhongoka* were recorded only from a few localities and are considered rare (**Table 7**). The survey revealed that the larger softshell turtles other than *Chitra indica* were common and wide spread in this zone.

All WS change to WLS

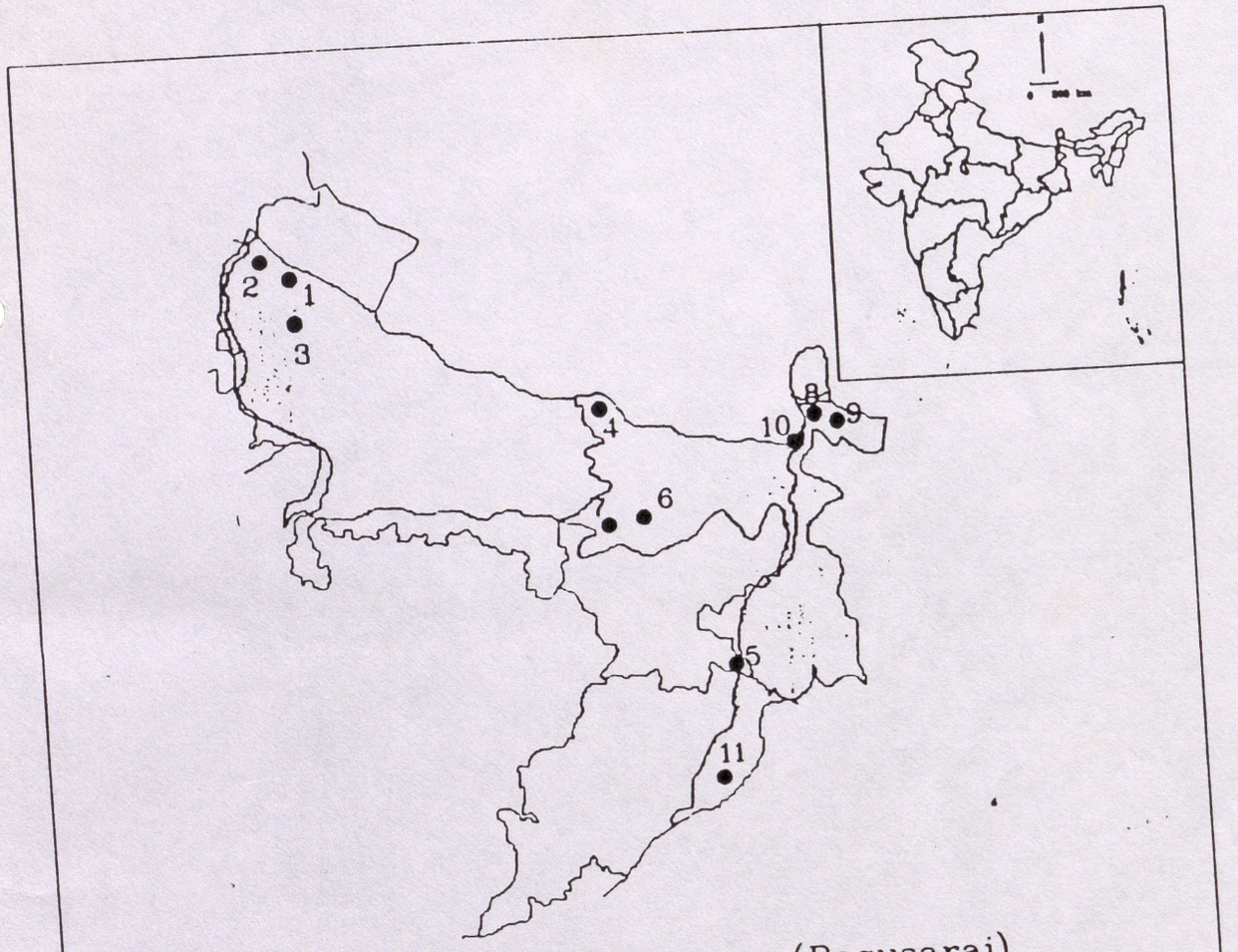


Fig.8 Gangetic plains bio zone showing survey localities

Table 7. Status of turtles in the Gangetic Plain Biogeographic Zone

No.	Species	Locality surveyed										
		1	2	3	4	5	6	7	8	9	10	11
1	*Cyclemys dentata*								3	9	3	
2	*Geoclemys hamiltonii*	1		1								
3	*Hardella thurjii*	1		1								
4	Kachuga dhongoka	1		1				3				
5	*K. kachuga*			1								
6	*K. smithii*	?		1	7							
7	*K. tecta*	1		1	1			1				P
8	*K. tentoria*	1		1	1		5	2		1		16
9	*Melanochelys tricarinata*	1	1		1					1		
10	*M. trijuga*	1	?						2	7		
11	*Morenia petersi*											
12	*Indotestudo elongata*	1	1			2			1	2		
13	*Aspideretes gangeticus*	1	1	1	7	1		2			3#	2
14	*A.hurum*	1		1	1				3	3?		P
15	Chitra indica	1		1	1			1				5
16	*Lissemys punctata*	2	3	1	2	3	2	3	1	2		3

Locality surveyed:

1. Corbett NP
2. Rajaji NP
3. Narora
4. Valmiki NP/WLS
5. Saranda RF
6. Kabar jheel
7. Ganges (Begusarai)
8. Gorumara WLS
9. Jaldapara WLS
10. Mahananda WLS
11. Mahanadi, Cuttack

VIII. **COASTAL ZONE**

The Indian coastal zone has 22 PA (Rodgers and Panwar 1988) and three of them were surveyed during the present study. They were, Sunderban TR, West Bengal; Bhitarkanika WLS, Orissa and Coringa WLS, Andhra Pradesh **(Fig. 9)**. The West coast PA were not covered in the present study. Five species were recorded and all of them occurred in the Sunderban TR **(Table 8)**. *Batagur baska* was recorded only from West Bengal. Occurrence of *Pelochelys cantorii* in the existing PA other than Sunderban TR is doubtful. The collections of the Sunderban TR at Sajanakhally has one each well preserved specimen of *Morenia petersi* and *Kachuga tecta* which are said to have been collected from the Sunderbans TR (P. Sanyal, Pers. Comm.). *Lissemys punctata* was common in all of the surveyed localities.

There are reports of the occurrence of *B. baska* in the Brahmani, Baitarani and Mahanadi delta (Bhitarkanika WLS) which could not be confirmed in the present survey. *Pelochelys cantorii* was also not recorded in the surveyed deltaic area of the above mentioned areas. However, this giant softshell is reported to occur in the northern part of coastal Orissa (ie. Balassore area, Moll and Vijaya 1986) which is an unprotected area.

All WS pl. change to WLS

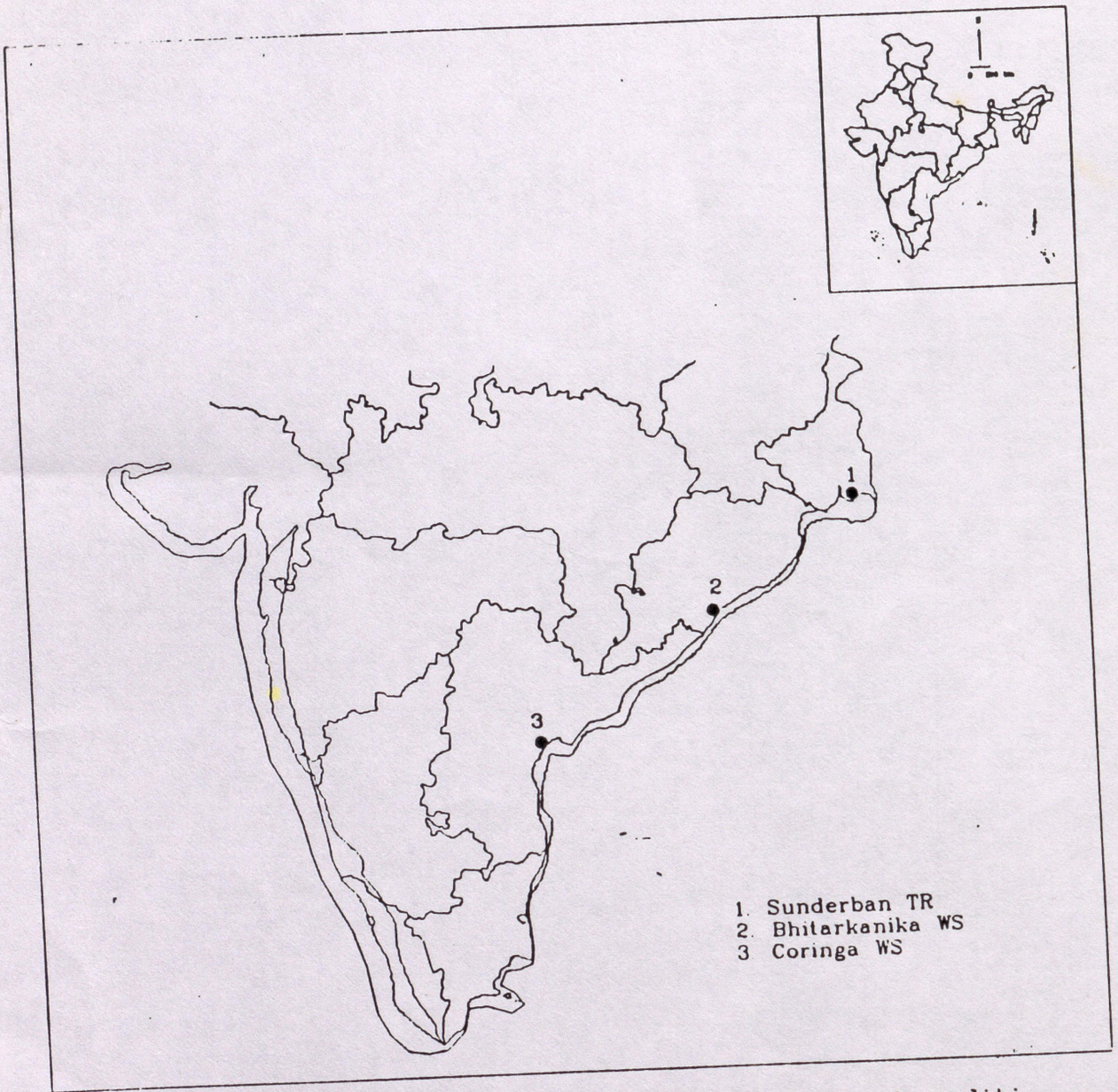


Fig.9 Coastal zone showing turtle survey localities

Table 8. Turtle fauna of Coastal Biogeographic Zone

No.	Species	Locality surveyed		
		Sunderban TR	Bhiatarkanika WLS	Coringa WLS
1	*Batagur baska*	1	?	-
2	*Kachuga tecta*	1	-	-
3	*Morenia petersi*	1	-	-
4	*Pelochelys cantorii*	1	?	-
5	*Lissemys punctata*	3	15	2

IX. **NORTHEAST INDIA**

This biogeographic zone covers in all the seven states of Northeastern India. Thirty three PA have been identified from this zone by Rodgers and Panwar (1988). Three PA (Kaziranga NP, Orang and Nameri WLS) and one unprotected area (North Cachar Hills, Assam) were surveyed during the present study (**Fig. 10**). Other states of this zone were not surveyed due to the political instability there during the survey

This zone has the highest number of species (18). This is due to the invasion of fauna from Indian, Indo-Malayan and Indo-Chinese faunal subregions, and also to the availabilty of various habitat types. The occurrence of fifteen species were confirmed in the localities surveyed in the present study. Many significant records were obtained, especially for softshell turtles; Indian softshell turtle (*Aspideretes gangeticus*) and Narrow-headed softshell turtle (*Chitra indica*). Both of them are additions to the Northeast faunal list. The known range of *A. hurum* was extended. Smaller hardshells were common in the riverine stretches but the occurrence or larger *Kachuga* spp. could not be confirmed. Larger hardshell species such as *Geoclemys hamiltonii* and *Hardella thurjii* are common in the oxbow lakes of the Brahmaputra flood plains **(Table 9)**. Information on select rare and endangered species of turtles is given below:

1. **Indian softshell turtle (*Aspideretes gangeticus*)**

One live turtle of this species was recorded in Bokakhat fish market i.e. adjacent to Kaziranga NP and eight individuals were recorded in Dibrugarh fish market, Assam. The fishermen reported that these turtles had been collected from the Brahmaputra river. Also, several softshell with light coloured shells were observed during the survey in Kaziranga NP (3), Orang WLS (1) and Nameri WLS (1). From the shell colour they have been tentatively identified as *A. gangeticus*. The occurrence of *A. gangeticus* in the Brahmaputra river system has not been recorded previously and hence adds to the faunal list of Northeast India.

2. **Indian peacock softshell turtle (*Aspideretes hurum*)**

This species was found in the North Cachar Hills (1 live turtle), Kaziranga NP (1 live and 3 shells), Dibrugarh fish market (1 live turtle). *Aspideretes hurum* has not been recorded from the North Cachar hills, Assam earlier, and is a significant range extension. This species appears to be common throughout the Northeast India.

All WS Pl. change to WLS

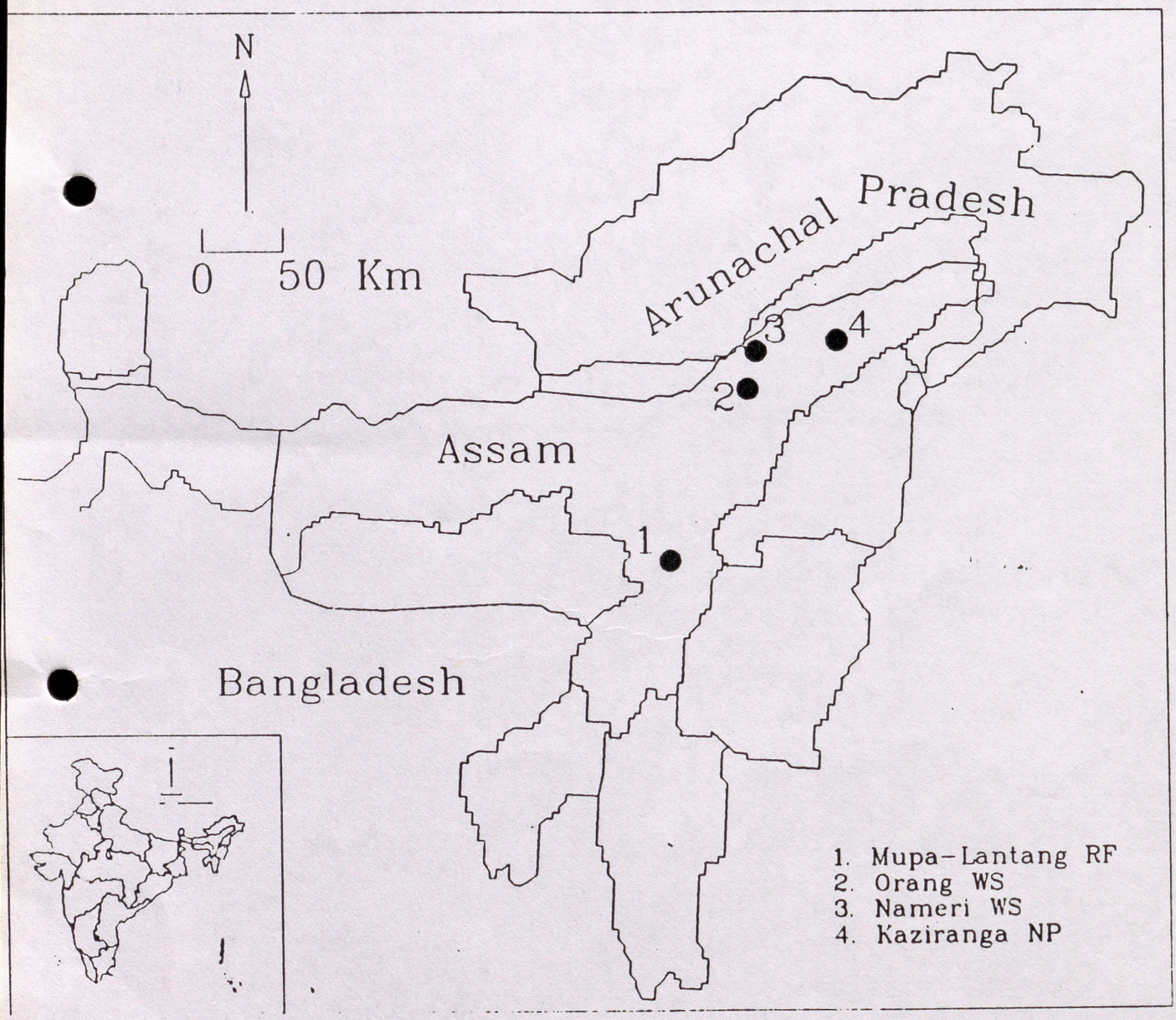


Fig.10 Northeast India zone showing survey localities

3. **Narrow-headed softshell turtle (*Chitra indica*)**

During the present survey, this species was recorded from Kaziranga NP (2) and Nameri WLS (1), Assam. The occurrence of the species in this zone was not reported earlier. The present records of *C. indica* indicate a significant range extension.

4. **Assam roofed turtle (*Kachuga sylhetensis*)**

Four shells and three live turtles of this species were recorded in the Nameri WLS, Assam. The occurrence of this turtle in Nameri has been reported earlier. *K. sylhetensis* inhabits in the hill streams.

5. **Asian brown tortoise (*Manouria emys*)**

Manouria emys is the largest Asian tortoise distributed in many parts of Southeast Asia. During the present survey it was located in North Cachar Hills, Assam. Five plastrons of this tortoise were recorded in Mupa-Lanteng RF near Meibang. All of the shells were recovered from *Kasari* Dimasa tribal camps. This tortoise has been reported previouly from the North Cachar hills.

Two sub species namely, *M. emys phayrei* (northern subspecies) and *M. e. emys* (southern subspecies) have been reported so far (Das 1991b). Also, it is recorded that both subspecies differ in the pectoral scute contact along the plastral midline, i.e. in the northern subspecies the pectoral scutes meet at the midline of the plastron; in the southern subspecies the pectorals are separate. Five plastrons of this tortoise were collected during this survey having plastron length 36.5, 38.0, 39.0, 40.0, 41.0 cm respectively. Of these, three had characteristics of the southern subspecies. The pectorals of these three specimens were seperated 2.5-3.8 cm away from the plastral midline. The other two plastrons had pectorals meeting each other on the midline (characteristic of the northern subspecies). The taxonomic status of the current subspecies assignment of *M. emys* is doubtful and needs re-evaluation (Bhupathy 1994). One example of each of the morphotypes is deposited with the collections of the WII-USFWLS Turtle project at the Wildlife Institute of India, Dehra Dun.

Terrestrial emydids (hardshell turtles)

Cyclemys dentata, *Cuora amboienensis*, *Pyxidea mouhotii* and *Melanochelys tricarinata* are rare semiaquatic turtles distributed in the Northeast.

Melanochelys tricarinata was recorded in Kaziranga NP (1 shell) and Orang WLS (1 live and 6 shells). The record of this species in Kaziranga NP and Orang WLS are additional localities for this species. This species appears to prefer wet grasslands and hill forests. *Cuora amboienensis* was also recorded in the same localities from marshy grasslands of Kaziranga NP (5 shells) and Orang WLS (2 shells), Assam. This species was recorded from there earlier. *Cyclemys dentata* was recorded in the North Cachar hills (3 live turtles and 5 shells), Nameri WLS (1 live turtle 5 shells), Assam. It is one of the common species

in these localities. *Pyxidea mouhotii* was recorded from North Cachar hills, Meibang, Assam.

The questionnaire survey indicated the presence of *P. mouhotii* in Dampha WLS, Mizoram (Nitin D. Rai, Pers. Comm., photo) and forests near by Imphal, Manipur (Ramakanth, Pers. Comm., photo, specimen alive at the Imphal Zoo, Manipur). Also, *Indotestudo elongata* was recorded from Dampha WLS, Mizoram (Nitin D. Rai, Pers. Comm., photo) and appears to be common there.

X. **ISLANDS**

Two species namely *Lissemys punctata* and *Cuora amboinensis* have been reported from Andaman and Nicobar Isalands. *L. punctata* is suspected to be introduced in these islands, whereas the *C. amboinensis* is a native species. Status of these species in the Andaman and Nicobar Islands is poorly known. An intensive survey in these islands may yield interesting results.

Table 9. Status of turtles in the Northeastern India Zone

No.	Species	Locality surveyed			
		Kaziranga NP	Mupa-Lantang RF	Nameri WLS	Orang WLS
1	*Cuora amboinensis*	5			2
2	*Cyclemys dentata*		8	1	
3	Geoclemys hamiltonii	60			2
4	*Hardella thurjii*	13			
5	*Kachuga smithii*	2			2
6	*K. sylhetensis*			7	
7	*K. tecta*	7			2
8	*K. tentoria*	8			1
9	*Melanochelys tricarinata*	1	1		7
10	*M. trijuga (*)*				
11	*Morenia petersi **				
12	*Pyxidea mohoutii*		3		
13	*Indotestudo elongata #*				
14	*Manouria emys*		5		
15	*Aspideretes gangeticus*	1	?	?	?
16	*A.hurum*	4	1	?	?
17	*Chitra indica*	2		1	
18	*Lissemys punctata*	2			

(*) Manas TR - Das (1991), * Smith (1931)
Dampha WLS- Nitin D. Rai Pers. Comm.

CHAPTER IV

EXPLOITATION OF FRESHWATER TURTLES AND TORTOISES

Freshwater turtles and land tortoises have been exploited throughout their range in India for food and medicine for hundreds of years. Exploitation of turtles and tortoises in India was at subsistence level until the mid 1970. However, along with the growth of organised fisheries and related markets, turtles as associated species in the aquatic system entered the new commercial avenue. Commercial exploitation has been particularly detrimental to those species especially whose distribution limits are small (ie. endemic and have a low reproductive capability); and which have late sexual maturity, small clutch size and low survival rate. The present investigation was undertaken to determine the turtle species involved in trade, localities from where they are exploited, methods and purpose of exploitation, trade routes and mode of transportation and socio-economics involved in the turtle trade. Detailed information on the status of the exploitation of freshwater turtles and land tortoises is available elsewhere (Choudhury and Bhupathy 1993).

METHODS

A countrywide food and pet market survey was conducted between August 1991 and May 1993. Calcutta markets were surveyed twice, once during monsoon (September 1991) and again in winter (January 1992), as this city is the known major marketing centre for turtles. The surveys were conducted between 07.00 and 11.00 hrs. and 15.00 and 18.00 hrs. in morning and evening markets respectively. Both surveys in Calcutta were conducted in a very rapid and clandestine manner to collect maximum information on turtle exploitation. Each survey was completed within a week. Surveys of markets other than Calcutta were coupled with field surveys. At each market, the number of species seen, number and approximate weight in kg. were noted. Queries also included the selling price per kilogram meat, source, capture method, and mode of transportation to trade centres.

RESULTS AND DISCUSSION

FOOD MARKETS

Sixty-one markets were surveyed throughout India (**Fig. 11**) of which seven were pet markets and the others were fish and animal product markets. In food markets the prices varied from Rs.15-200/- per kg of turtle meat. Turtle meat was sold at a very low price in Southern India (Rs. 15.00), whereas it was Rs.150-200/- per kilogram in Northeast India (**Table 10**). Markets, other than Calcutta, received turtles from local sources and never from far away places.

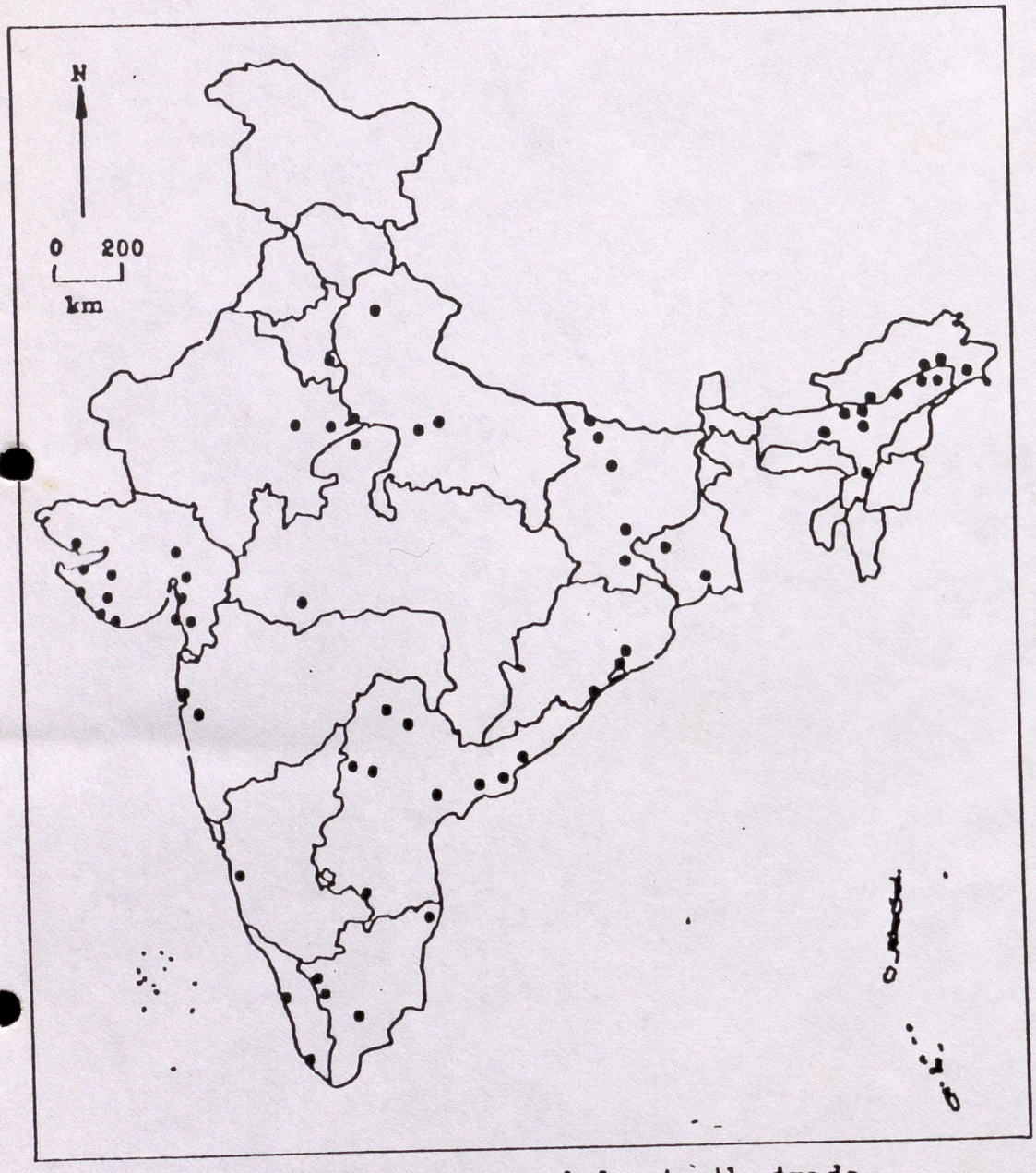


Fig. 11 . Markets surveyed for turtle trade

Turtle Trade in Calcutta

A total of 25 and 23 fish, meat and other markets were surveyed in Calcutta during monsoon and winter respectively. Turtles were sold only in 6 (24%) and 5 (21.7%) markets respectively (**Table 11**).Only three species namely *Aspideretes gangeticus*, *Lissemys punctata* and *Hardella thurjii* were recorded in the markets. No exploitation of the other large softshells namely, *A. hurum, A. leithii* and *Chitra indica* was recorded during the present survey. During the monsoon season, the exploitation of larger softshells was higher when compared with winter (**Table 11**). The quantity of turtles in each market varied from 1-70 kg. and the price of one kilogram of turtle meat varied between Rs.30 and 50. There was not much difference in the turtle exploitation between survey seasons. However, in the monsoon the most exploited species was *A. gangeticus*, whereas during winter it was *L. punctata*. A shift in the markets selling turtles was observed between monsoon and winter (**Table 11**) ie. during the monsoon (September 1991) turtles were sold within the metro limits, whereas the sales shifted to the outskirts during winter (January 1992). This is attributed to the frequent raids conducted by the Forest Department and Wildlife Preservation officials (**Table 12**).

Table 10. Turtle exploitation records in India during 1991-93; *Price in pet market is Rupees/turtle*

Market location	Species	Price/ kg	Remarks
Calcutta	*Lissemys punctata*, *Aspideretes gangeticus*, *Hardella thurjii*	40-50	Food market
Bokakhat, Assam	*Aspideretes gangeticus*	150-175	Food market
Dibrugarh	*Aspideretes gangeticus*, *A.hurum*	175-200	Food market
Begusarai	*Lissemys punctata*	60	Food market
Hyderabad	*Lissemys punctata*	20	Food market
Poona	*Lissemys punctata*	15	Food market
Bangalore	*Geochelone elegans*	75-125	Pet market
Kargal, Karnataka	*Melanochelys trijuga*	15	Food market
Trissur, Kerala	*Lissemys punctata*	30	Food market
Trivandrum	*Melanochelys trijuga*	40	Pet market

Table 11. Turtle trade records in Calcutta between September 1991 and January 1992

Market	Monsoon survey		Winter survey	
	Species	Quantity (Kg)	Species	Quantity (Kg)
Bidhannagar*	*Aspideretes gangeticus*, *Hardella thurjii*	60,10	-	-
Ultadanga*	*Aspideretes gangeticus*	25	-	-
Dum Dum*	*Aspideretes gangeticus,*	25	*Lissemys punctata*	10
New Barackpur	*Aspideretes gangeticus*	16	*Lissemys punctata*	35
Talleygunj*	*Aspideretes gangeticus, Lissemys punctata*	4,5	-	-
Utterpara	*Lissemys punctata*	1	-	-
Madyamgram	-	-	*Lissemys punctata*	10
Barasat	-	-	*Lissemys punctata*	15
Sodepur	-	-	*Lissemys punctata*	40

Note: * Markets inside the city limit

Collection centres and trade routes

Major cities and towns along the Ganges and its tributaries in Uttar Pradesh and Bihar were reported to be the collection centres for turtles to be sent to Calcutta. Turtle consignments are reported to have been sent to Calcutta from Punjab (Harike lake), Jammu & Kashmir (Jammu), Orissa (Cuttack, Chawdwar, Naraj) and Andhra Pradesh (Rajahmundry, Vijayawada).

Till recently (early 1991) the destination used to be Bandel and Sealdah for Northern Railway consignments and Howrah for South-Eastern Railway consignments. Of late, however, the West Bengal wildlife officials suspect the destination to have changed to Diamond harbour and nearer to the Bangladesh border - Basheerhat. It is suspected that the turtle trade is now operational across - India - Bangladesh border.

Table 12. Turtles confiscated by wildlife officials in Calcutta between 1991 and 1993

Turtle species	Turtle confiscation		
	1991	1992	1993*
Lissemys punctata	4053	2735	1134
Aspideretes gangeticus	105	189	64
Hardella thurjii	1	-	-
Geochelone elegans	289	2	-
Total	4448	2926	1198

Note: * Data of 1993-upto March.

Trends of Commercial trade

The commercial trade on turtles still persists in India. Compared to the 1983 survey of Moll, where he recorded as many as ten species in trade, the present extensive investigation recorded only seven species

(**Table 13**). While five species, *Hardella thurjii*, *Lissemys punctata*, *A.gangeticus, A.hurum* and *A.leithii,* continue to be in the trade, two other species *Melanochelys trijuga* and *Geochelone elegans*, have now entered the trade. A comparison of turtle species in trade during 1983 and 1993 is given in **Table 13**. Large hardshells of the genus *Kachuga*, *Hardella* and the softshell *Chitra* which reportedly constituted the bulk of turtles in Calcutta markets, were not seen in the markets during this survey. It is not clear whether these species became rare in the traditional collection locality or not. Compared to the turtle trade situation in India documented by Moll in 1983 (Moll 1991), the present level of trade appears to be in low key. The West Bengal Forest Department has done a commendable job in curbing the illegal turtle trade in Calcutta fish markets.

Table 13. Frequency occurrence of markets having turtle species in india during last 10 years

Species	Moll (1984)	Present study (1993)
Hardella thurjii	9	1
Kachuga dhongoka	7	-
Kachuga kachuga	3	-
Kachuga tecta	3	-
Kachuga tentoria	7	-
Melanochelys trijuga	-	2
Geochelone elegans *		1
Lissemys punctata	22	7
Aspideretes gangeticus	17	3
A. hurum	9	1
A. leithii	2	1
Chitra indica	11	
No. of markets surveyed	35	61

Note: * Species not included in the survey by Moll in 1983

PET TRADE

Eventhough several species of tortoises and freshwater turtles were kept in captivity in India, only *Geochelone elegans*, *Melanochelys trijuga* and *Kachuga tecta* have entered into the pet trade. There are unconfirmed reports of some trade involving *Kachuga sylhetensis (* Das 1991b). This could not be confirmed in the present study.

The southern thorn forests bordering Karnataka, Andhra Pradesh and Tamil Nadu, Mansaur district of Madhya Pradesh, costal dry scrub forests in Andhra Pradesh and Orissa coast and the Saurashtra, and Kutch region of the Northwestern India are the localities from where most *Geochelone elegans* are exploited.

Price range and exploitation level

Two pet markets namely, the Shivaji market in Bangalore and the Narmada pet shop in Trivandrum, turtles were sold. The value of one turtle varied from Rs. 40.00 (*Melanochelys trijuga*) to Rs. 75-125.00

(*Geochelone elegans*). At market prices ranging from Rs. 75-125 per tortoise, the trade within India may be in the range of Rs. 5,00,000/- annually with an estimated sale of upto 5000 individuals.

At the quoted price of US $ 65 (Amsterdam Confiscation) and reported price of upto US $ 300 in US (John Behler, Pers. Comm.) for individual, the outside trade of *G. elegans* may be in the range of US $ 500,000 annually at present. From the confiscation and from discussions with animal dealers and professional trappers, the quantity of *G. elegans* that enters into export and internal trade is estimated to be above 10,000 annually. Several PA in the country could perhaps assure the survival of the species but only in a fragmented fashion.

CHAPTER V

FRESHWATER TURTLES AND LAND TORTOISES IN CAPTIVITY AND EX-SITU CONSERVATION

Ex-situ conservation measures are adopted for species in critically endangered status. This is usually done by captive breeding of the species concerned and restocking in the wild for building up population. In many cases, captive breeding involve collection of breeding animals (males and females) from the wild which can ultimately deterioate the status of natural populations. This may be avoided if the data base is available on the stock of animals in captivity. Hence, an inventory of freshwater turtles and land tortoises in captivity was initiated. This would help in locating rare turtles in captivity which could be used in the captive breeding programmes in a more coordinated way. Also, collections of rare turtles from the wild may be avoided. This chapter reports the results of the survey conducted to prepare an inventory on the freshwater turtles and land tortoises in Indian zoos, Zoological Parks (ZP) and other Captive Breeding Centre (CBC). Also, based on the findings of the present study, Captive Breeding Units are suggested for select species of Indian chelonians.

METHODS

The captive stock of turtles in Indian zoos was inventoried using a questionnaire survey and by visits to zoos by the Turtle Project scientists. Questionnaires were sent to various zoos, ZP and CBC requesting information on turtle species concerning their collection, number and breeding status. Also, a request for information was published in `ZOOS' PRINT' a magazine published for and received by all Indian zoos **(Appendix VI**).

RESULTS AND DISCUSSION

The proforma was sent to 120 Indian zoos, ZP and CBC and information on the captive stock of turtle was received from 36. Among them 31 were zoos and the remaining five were special turtle captive breeding centres. Of these feedback were received from 18 animal collection centres and 25 centers were visited (**Table 14**).

1. **Turtle species in captivity**

Altogether, 30 Indian zoos/CBC/ZP had collections of one or more species. A total of 19 species of Indian chelonians were recorded in captivity **(Table15**). The commoner ones were *Lissemys punctata* and *Geochelone elegans*. *L. punctata* were exhibited in as many as 22 centres, and *G. elegans* in 20. All Indian softshell turtles except *Pelochelys cantorii* were displayed in one or more zoos/CBC/ZP.

2. **Breeding records**

Only 10 Indian zoos/CBC/ZP were successful in breeding (either attempted or accidental) of one or more turtle species. Altogether, 9 species bred in Indian zoos. Six zoos had breeding records of *G. elegans*. Breeding of chelonian in most of the Indian zoos is accidental. Systematic captive breeding experiments are being carried out in 'special turtle breeding centres'. Their details are given below:

Table 14. Status of turtle and tortoises in Indian Zoos/Captive Breeding Centres (CBC)

Name of the CBC	No.of species		Breeding species
	Present	Breeding	
Balbhavan, Rajkot	2	2	*G. elegans*, *L. punctata*
Jaipur Zoo	1	-	-
S.Gandhi NP,Borivli	-	-	-
Sakkarbaug Zoo, Junagadh	2	1	*G. elegans*
Vanvihar NP, Bhopal	7	-	-
Sanke Park & Aviary, Pune	1	-	-
Madras Corc.Bank	11	3	*M. trijuga*, *I. forstenii*, *L. punctata*
Children Park, Bangalore	-	-	-
P.Naidu HZP, Dargeeling	-	-	-
Mini Zoo, Port Blair	1	-	-
Sayaji Baug Zoo, Vadodra	6	4	*K. tecta*,*G.elegans*,*L. punctata*, *A. gangeticus*
NZP, New Delhi	1	-	-
Nandankanan BP	7	-	-
Nagar Haveli, Silvassa	-	-	-
*Chambal Sanctuary, Deori	6	6	*K.dhongoka*, *K.kachuga*, *K.tentoria*, *L. punctata*,*C. indica*, *A. gangeticus*
Zool.Garden, Alipur	3	-	-
I.Gandhi ZP,Vizak	3	1	*G. elegans*
A.Anna ZP, Madras	2	-	-
Madras Snake Park	4	1	*M. trijuga*
Trivandrum Zoo	2	-	-
Banegatta NP	2	-	-
Guwahati Zoo	1	-	-
Miao Zoo, Miao	3	-	-
*Kukrail Turtle Centre	10	-	-
Nagpur Zoo	2	-	-
Nehru ZP,Hyderabad	5	2	*G. elegans*, *M. trijuga*
Mini Zoo,Warangal	1	-	-
Prince Wales, Lucknow	3	-	-
Surat Zoo, Surat	4	-	-
Kanpur Zoo	1	-	-
GNFC Wildlife Park, Bharuch	2	-	-
Salt Lake City	4	-	-
*Sajanakhali CB	1	-	-
Itanagar Zoo	-	-	-
Roing Zoo	-	-	-
Sasan Croc.Complex	1	1	*G. elegans*
Saranath, Varanasi Turtle Breeding Centre	-		

Note: * Captive breeding centres

Special Turtle breeding centres

At present India, has atleast five turtle breeding centres with varying degree of infrastructure facilities. These centres were basically started for captive breeding of crocodiles. They are,

a. **Madras Crocodile Bank Trust (MCBT), Chennai**

The MCBT is located near Chennai. This centre was initiated for conducting field research on Indian crocodiles. Later, it developed captive breeding facilities for crocodiles. Currently, MCBT is developing breeding facilities for many endangered reptiles including turtles. The MCBT has 11 Indian turtle species and three of them are rare and endangered; *Batagur baska*, *Kachuga kachuga* and *Indotesudo forstenii.*

b. **Gharial Breeding Centre (GBC), Deori, Madhya Pradesh**

The GBC, Deori center is located on the southern bank of Chambal river in Madhya Pradesh. This centre is being maintained by the Madhya Pradesh state Forest Department. It has collections of both hardshells and softshells. At GBC, Deori turtle eggs are being collected from the wild and artificially hatched. The breeding programme of turtles was started in 1987. Currently, this centre has about 75 hardshells and 20 softshells. Important rare species in the collection of this centre is *Kachuga kachuga (*12 nos.).

Table 15. Breeding records of chelonians in Indian Zoos and Captive Breeding Centres (CBC).

Species	No.of CBC with turtles	No.of CBC with breeding turtles
Lissemys punctata	23	4
Aspideretes gangeticus	12	1
Aspideretes hurum	3	-
Aspideretes leithi	2	-
Chitra indica	1	1
Batagur baska	3	-
Kachuga tecta	4	1
Kachuga tentoria	7	2
Kachuga dhongoka	4	-
Kachuga smithii	2	-
Kachuga kachuga	4	1
Hardella thurgi	2	-
Melanochelys trijuga	7	3
Geoclemys hamiltonii	2	-
Cyclemys dendata	1	-
Pyxidea mohouti	1	-
Geochelone elegans	20	6
Indotestudo forstenii	1	1
Indotestudo elongata	1	-

c. **Varanasi Turtle Breeding Centre**

The Varanasi turtle breeding centre is located nearby Ganges. This breeding centre is being run by the Uttar Pradesh Forest Department and is funded by the Ganga Cleaning Project, Government of India. Softshells are largely scavengers which help cleaning the aqatic system. Hence, softshells are used to clean the polluted Ganges river. Softshell species eggs are being collected from wild for artificial hatching for restocking to clean the dead bodies and other pollutants thrown into Ganges. This centre has facilities for artificial hatching of softshells and rearing of young ones. Currently, this centre has about 14,000 softshells (ie. *Lissemys punctata* (5 nos), *Aspideretes gangeticus* (13,891 nos.) and *A. hurum* (74 nos.).

d. **Kukrail Turtle Breeding Centre**

This centre is a part of the Uttar Pradesh State Forest Department's programme of Rare and Endangered Species Captive Breeding and Reintroduction Programme. The Kukrail centre has about 4500 turtles, mostly derived from artificial hatching of wild collected turtle eggs. Turtles are also being collected from the wild for captive breeding. Important species in the collections of Kukrail Turtle Breeding Centre are *Geoclemys hamiltonii*, *Kachuga kachuga (10 no)*, *Aspideretes gangeticus* (4000 hatchlings) and *A. hurum* (16 nos.).

e. **Sajanakhali River Terrapin Breeding Centre**

This programme was launched by the West Bengal Forest Department in 1988. This centre collects *Batagur baska* eggs from the wild and hatch them artificially for reintroduction. In April 1993, this centre had about 175 *Batagurs* of different size classes. In addition to the rearing facility, there is a plan for constructing breeding enclosures for *Batagur.* However, recently, the centre released all of the captive reared *Batagur* in the wild and currently it is not functioning.

The survey, especially the personal visits to different zoos revealed the following basic problems:

- **Identification**: There appears to be a major difficulty in identification of species exhibited in the zoo. The officials of 6 (25.3 %) out of 24 centres/zoos visited were unaware of the species name of one or more turtles or tortoises which were exhibited in their centers. Three out of 24 zoos (ie. 13%) had incorrect displays regarding species name, distribution, habitat and food habits.
- **Housing**: Most of the zoos visited displayed turtles with other animals (ie. using them as scavengers). This is partly due to the lack of knowledge on the turtle housing procedure.
- **Diet and Health care**: Little attention was given to turtle food and care in many of the zoos. This results in high mortality. All of this indicates that training is required for zoo officials regarding turtle identification, housing, diet and health care. The project is suggesting a few major zoos to start pilot programme of displaying turtles separately. Captive breeding units are suggest for select species of freshwater turtle and land tortoise.

CAPTIVE BREEDING: SPECIES AND CENTRES SUGGESTED

Captive breeding of riverine hardshells (*Kachuga kachuga*, and *K.dhongoka*) and softshell (*Chitra indica*), estuarine species *Batagur baska* and *Pelochelys cantorii* and *Manouria emys* is urgently needed. The above mentioned species are suggested for captive breeding because of their, 1. rarity, 2. narrow distribution range and 3. specialization in habitat use. All the above mentioned species are rare and may become locally extinct in near future.

Riverine species such as *K. kachuga*, *K.dhongoka*, and *C. indica* may be bred at suitable locations in U.P and Bihar for reintroduction in Ganges. Already turtle breeding facilities are available at Deori Gharial Breeding Centre, Madhya Pradesh and Kukrail Turtle Breeding Centre, Lucknow in Uttar Pradesh. These may be utilised for this purpose.

Estuarine species namely *B. baska* and *P. cantorii* could be bred in Sunderbans TR for reintroduction as these species have become very rare in the wild. Turtle Breeding facilities at Sajanakhally and Pakiralaya of the Sunderban TR may be used for this purpose.

Manouria emys is heavily utilised by the inhabitants of this area. This is the largest tortoise species seen in Asia. A captive breeding programme may be initiated at Mupa-Lantang RF for reintroduction in North Cachar Hills and nearby forests.

CHAPTER VI

STATUS AND DISTRIBUTION OF CHELONIANS IN VARIOUS STATES AND ACTION PLANS

1. ANDHRA PRADESH

The state Andhra Pradesh has two biogeographic zones within its boundary; Deccan Plains (VI) and Coastal zone (VIII). Two major rivers of the South India namely the Godhavary and Krishna flow through this state. Twenty two PA were itentified in this state by Rodgers and Panwar (1988) of which 10 were surveyed for turtles and tortoises during the present study **(Fig.12)**.

Six species of freshwater turtles and land tortoises have been confirmed in Andhra Pradesh **(Table 16)**. *Lissemys punctata* and *Aspideretes leithii*) were common (Chapter IV, Sec. Deccan Plains). Andhra Pradesh is the southern limit of at least two species of frsehwater turtles; *Chitra indica* and *Kachuga tentoria*. *Geochelone elegans* appears to be wide spread in this state. However, status of the population of this species in the wild needs to be determined.

Table 16. Turtle status and Action Plan: Andhra Pradesh

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Indian tent turtle *Kachuga tentoria*	Common	Required			
2	Indian black turtle *Melanochelys trijuga*	Common				
3	Indian star tortoise *Geochelone elegans*	Common		Required	Madanapally Forests	
4	Leith's softshell turtle *Aspideretes leithii*	Uncommon				
5	Narrow-headed softshell turtle *Chitra indica*	Rare	Required			
6	Indian flapshell turtle *Lissemys punctata*	Common				

C. indica is widely distributed in India (North of river Krishna) and elsewhere in Southeast Asia. This softshell turtle was recorded for the first time in main stream Krishna river. *C. indica* was reported from the Godhavary river by Moll (1984). The present survey could not gather direct evidence for the existance of this species there and hence, a survey is required to acertain the status of this species. This species is eaten by the inhabitants all along the Krishna and Godhavary river course. As mentioned above this species appears to be rare in the Godhavary river and hence, exploitation control is required. *K. tentoria* was reported to inhabit the Krishna river but could not be traced in the present survey. An intensive survey is suggested to assess the status of this species in the Krishna river.

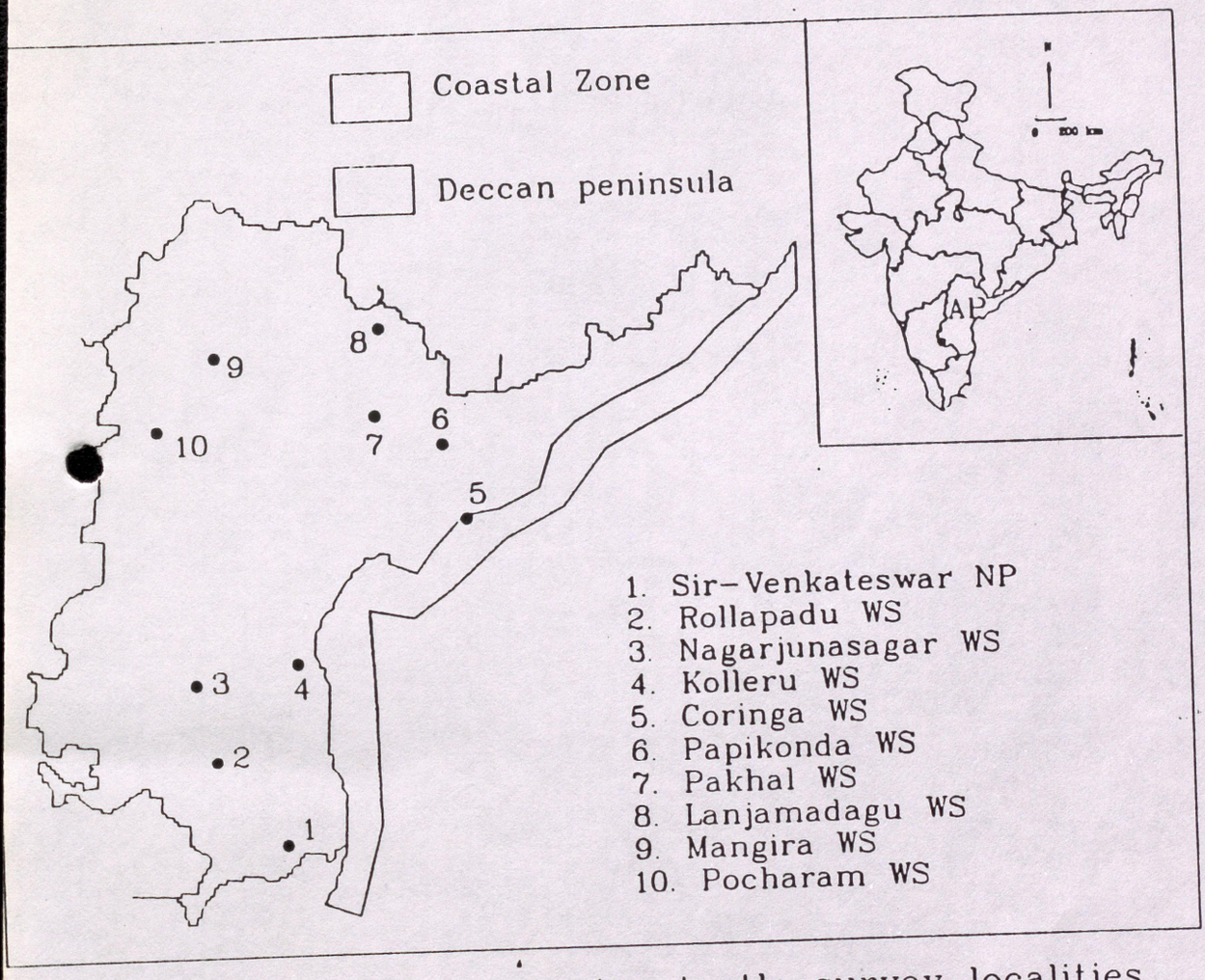


Fig 12 Andhra Pradesh showing turtle survey localities

All WS to WLS

Thorn forests of Madanapalle RF, Andhra Pradesh bordering Tamil Nadu and Karnataka appears to be suitable for *G. elegans.* Organised trade is going on in this locality. During the field surveys several tortoise collecters were encountered. A net work exists with animal dealers in Bangalore, Bombay and Madras. Hence, exploitation control is suggested. Also, Reserve Forests in and around Madanapalle should be declared as a WLS to protect the tortoise and many other thorn forest dwellers. The elevation of the RF status to WLS would enhance the protection of the area.

2 **BIHAR**

Bihar has two biogeographic zones within its political boundaries. They are, the Deccan Peninsula (VI) and Gangetic Plains (VII). This state has extensive network of river systems especially the Ganges. Twenty one PA have been identified in Bihar by Rodgers and Panwar (1988). Two PA namely Dalma WLS and Valmik TR and three unprotected areas; Saranda RF, Kabar jheel and Ganges near Begusarai were surveyed during the present study **(Fig 13)**. The Ganges system in Bihar and Uttar Pradesh was surveyed extensively in 1983 by Moll (1991).

Fifteen species of freshwater turtles and land tortoises have been recorded from Bihar **(Table 17)**. *Lissemys punctata* and *Aspideretes gangeticus* were common throughout Bihar (Chapter IV). Smaller hardshells (*Kachuga* spp.) were common in the riverine stretches of the Ganges system. *Kachuga smithii* was common in the northern parts of this state (Chapter IV and Moll 1991). Moll (1991) reported the occurrence of larger *Kachuga* spp. from Gandak, Bettiah and Ganges river near Rajmahal. However, the present survey could not confirm this. During the present survey *Kachuga dhongoka* was common in Ganges near Begusarai.

As larger harshells were not recorded in many previously reported localities from Bihar, these species were considered as rare. An intensive survey would yield precise data on localities and status. Viable population of *Morenia petersi* was reported to occur in the Gandak river, West Chambaran district (Moll 1991) but could not be confirmed during the present survey. Additional surveys are required to determine the status and extent of this species distribution. *Cyclemys dentata* may possibly occur in Bihar as this species was recorded in the Northern West Bengal bordering Nepal and this state and hence, a survey is required for this species. Gangetic Bihar is reported to be the collection center for larger softshell and hardshell turtles for the markets of Calcutta (Choudhury and Bhupathy 1993). Also turtles were being eaten by the inhabitants near by Valmik TR. Hence, exploitation control is required. Valmik TR and adjacent areas have a high diversity of turtle species (Moll 1991 and the present survey). Larger hardshells namely, *Kachuga kachuga* and *K. dhongoka* are rare throughout their range and hence captive breeding is suggested for reintroduction.

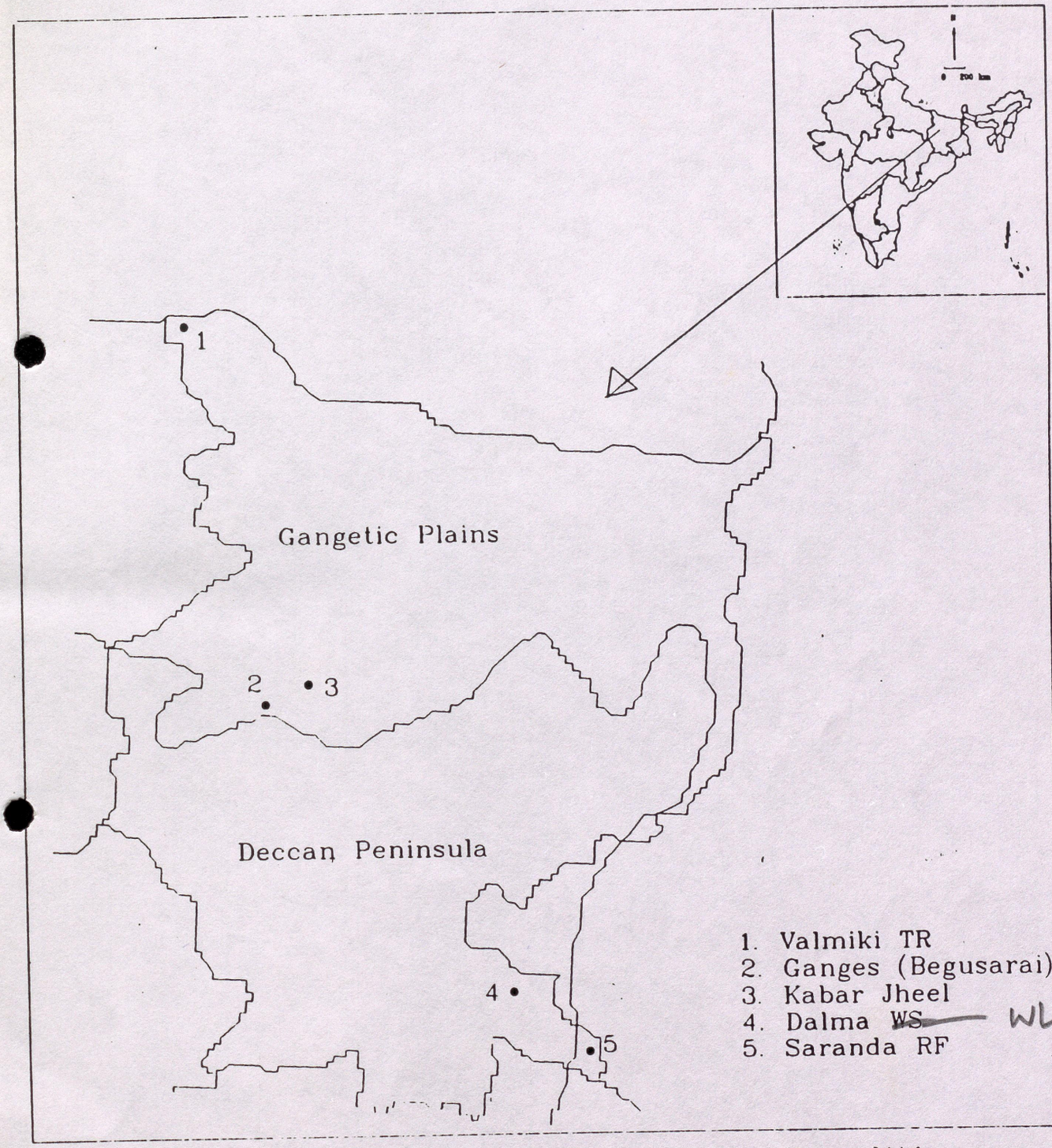


Fig.13 Bihar showing turtle survey localities

Table 17. Turtle status and Action Plan: Bihar

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Asian leaf turtle, *Cyclemys dentata*	?	Required			
2	Spotted pond turtle, *Geoclemys hamiltonii*	Uncommon				
3	Crowned river turtle, *Hardella thurjii*	Rare				
4	Three-striped roofed turtle, *Kachuga dhongoka*	Rare	Required	Required		Required
5	Red-crowned roofed turtle, *K. kachuga*	Rare	Required			Required
6	Brown roofed turtle, *K. smithii*	Common				
7	Indian roofed turtle, *K. tecta*	Common				
8	Indian tent turtle, *K.tentoria*	Common				
9	Tricarinate hill turtle, *Meladnochelys tricarinata*	Rare				
10	Indian black turtle, *M. trijuga*	Rare				
11	Indian eyed turtle, *Morenia petersi*	Uncommon	Required			
12	Elongated tortoise, *Indotestudo elongata*	Rare				
13	Indian softshell turtle, *Aspideretes gangeticus*	Common		Required		
14	Indian peacock softshell turtle, *A.hurum*	Rare		Required		
15	Narrow-headed softshell turtle, *Chitra indica*	Rare		Required		
16	Indian flapshell turtle, *Lissemys punctata*	Common				

? Species occurrence suspected

3. **GUJARAT**

Four biogeographic zone namely Indian Desert (III), Semiarid (IV), Western Ghats (V), Coast (VIII) exist in the state Gujarat (Rodgers and Panwar 1988). Twenty two PA have been recognised in this zone. Five localities were surveyed, of which two were PA and the remaining areas (3) were unprotected areas **(See Chapter IV, Fig. 14)**. A recent update is available regarding the turtle fauna of Gujarat (Vyas and Patel 1990). Vyas and Patel (1990) deals with the turtle fauna of southern Gujarat especially of Dangs WLS.

Six species of freshwater turtles and land tortoises have been recorded in Gujarat **(Table 18)**. *Melanochelys trijuga* was recorded in Dangs WLS, Western Ghats and it is common there (Vyas and Patel 1990). *Kachuga tecta* is common in south and central Gujarat. *Aspideretes gangeticus* and

Lissemys punctata were common all over Gujarat. Only one record is available for *K.tentoria (* Vyas and Patel 1990) and may be considered as rare. This is the first record of this species being recorded in this state. *Geochelone elegans* was wide spread in arid and semiarid zones of this state and it is common. Many reports on the exploitation of *G. elegans* are available in recent years (Choudury and Bhupathy 1993). Hence, exploitation control is suggested for this species.

Table 18. Turtle status and Action Plan: Gujarat

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Indian black turtle, *Melanochelys trijuga*	Common				
2	Indian tent turtle, *Kachuga tentoria*	Rare				
3	Indian roofed turtle, *K. tecta*	Common				
4	Indian star tortoise, *Geochelone elegans*	Common		Required		
5	Indian softshell turtle, *Aspideretes gangeticus*	Common				
6	Indian flapshell turtle, *Lissemys punctata*	Common				

4. **HARYANA**

Rodgers and Panwar (1988) recognised only one biogeographic zone in this state; Semiarid (IV) and identified seven PA. This state was not included in the present survey. However, some information on the turtle fauna of the Sultanpur WLS is available (Bains, Pers. Comm.). Species such as *Lissemys punctata*, *Aspideretes gangeticus*, *Kachuga tecta* and *K. tentoria* have been recorded from there. Four more species (three hardshell and one softshell turtles) may occur in the river Yamuna **(Table 19)** which require confirmation. An intensive survey is suggested for this state.

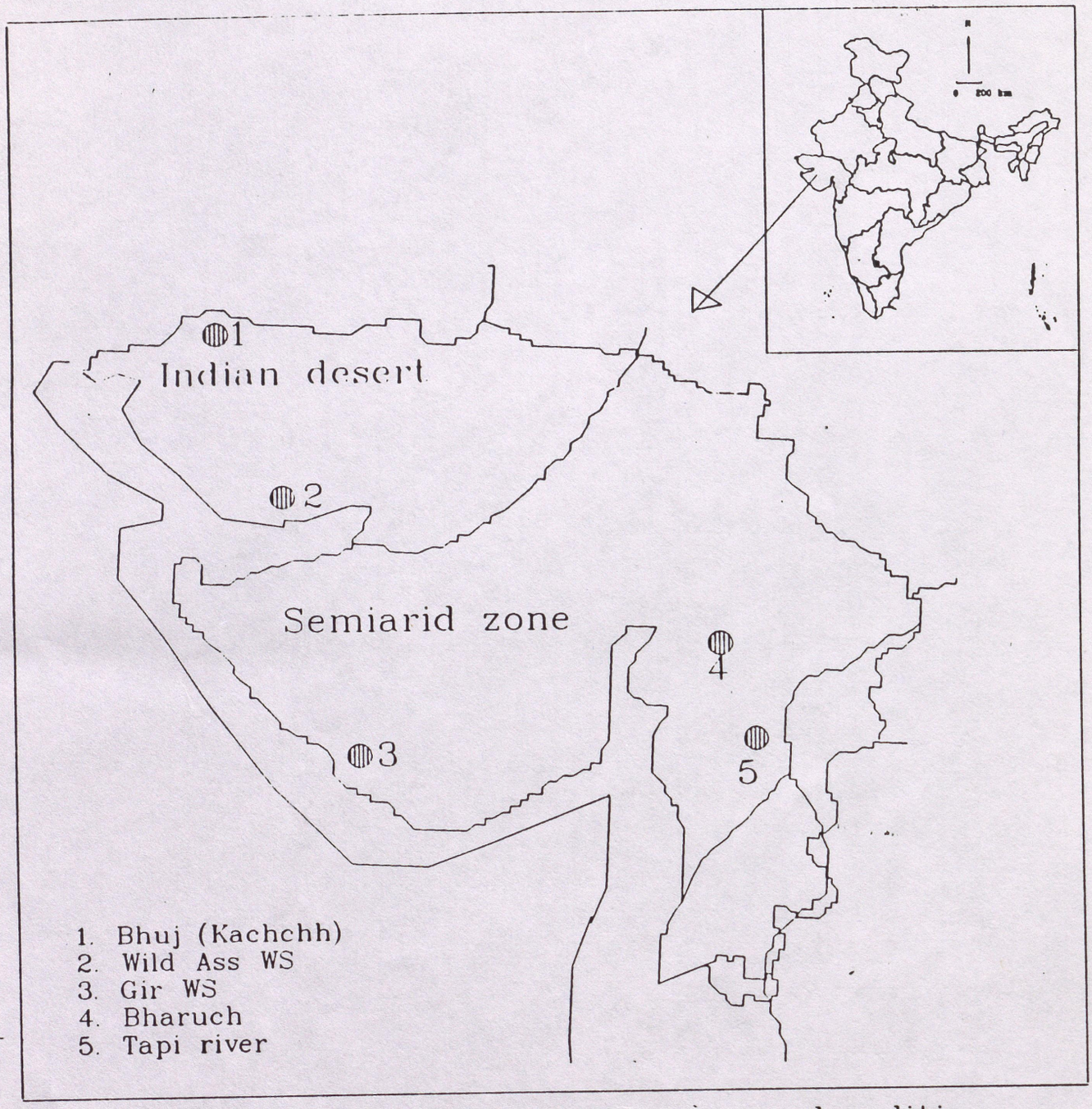


Fig.14 Gujarat showing turtle survey localities

All WS → WLS

Table 19. Turtle status and Action Plan: Hariyana

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Spotted pond turtle, *Geoclemys hamiltonii*	?	Required			
2	Crowned river turtle, *Hardella thurjii*	?	Required			
3	Three-striped roofed turtle, *Kachuga dhongoka*	?	Required			
4	Indian roofed turtle, *K. tecta*	Common	Required			
5	Indian tent turtle, *K. tentoria*	Common	Required			
6	Indian softshell turtle, *Aspideretes gangeticus*	Rare	Required			
7	Indian peacock softshell turtle, *A.hurum*	?	Required			
8	Indian flapshell turtle, *Lissemys punctata*	Common				

5. **HIMACHAL PRADESH**

Two biogeographic zones namely Himalayas (II) and Semiarid (IV) are recognised in Himachal Pradesh (H.P.). Thirty Wildlife Sanctaries (WLS) have been recorded in this state by Rodgers and Panwar (1988). Excepting two PA, all are located in the Himalayan zone. Only one PA, Simbalbara WLS was surveyed **(Fig. 15)**. The occurrence of *Melanochelys trijuga* and *Lissemys punctata* was confirmed in Himachal Pradesh **(Table 20)**. The record of *M. trijuga* in the Simabalbara WLS is a range extension for this species. This is the known westernmost range of this species. Four more species, two small hardshells (*Kachuga* spp.), one softshell (*Aspideretes hurum*) and one tortoise (*Indotestudo elongata*) probably also occur in this state in appropriate habitats ie. hardshells and softshell species in the Yamuna river and tortoise in the Sal forest. Further surveys are suggested for this state.

Table 20. Turtle species status and Action Plan: Himachal Pradesh

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Indian roofed turtle, *Kachuga tecta*	?	Required			
2	Indian tent turtle, *K. tentoria*	?	Required			
3	Indian black turtle, *Melanochelys trijuga*	Rare	Required			
4	Elongated Tortoise, *Indotestudo elongata*	?	Required			
5	Indian softshell turtle, *Aspideretes gangeticus*	?	Required			
6	Indian flapshell turtle, *Lissemys punctata*	Rare				

all WS → WLS

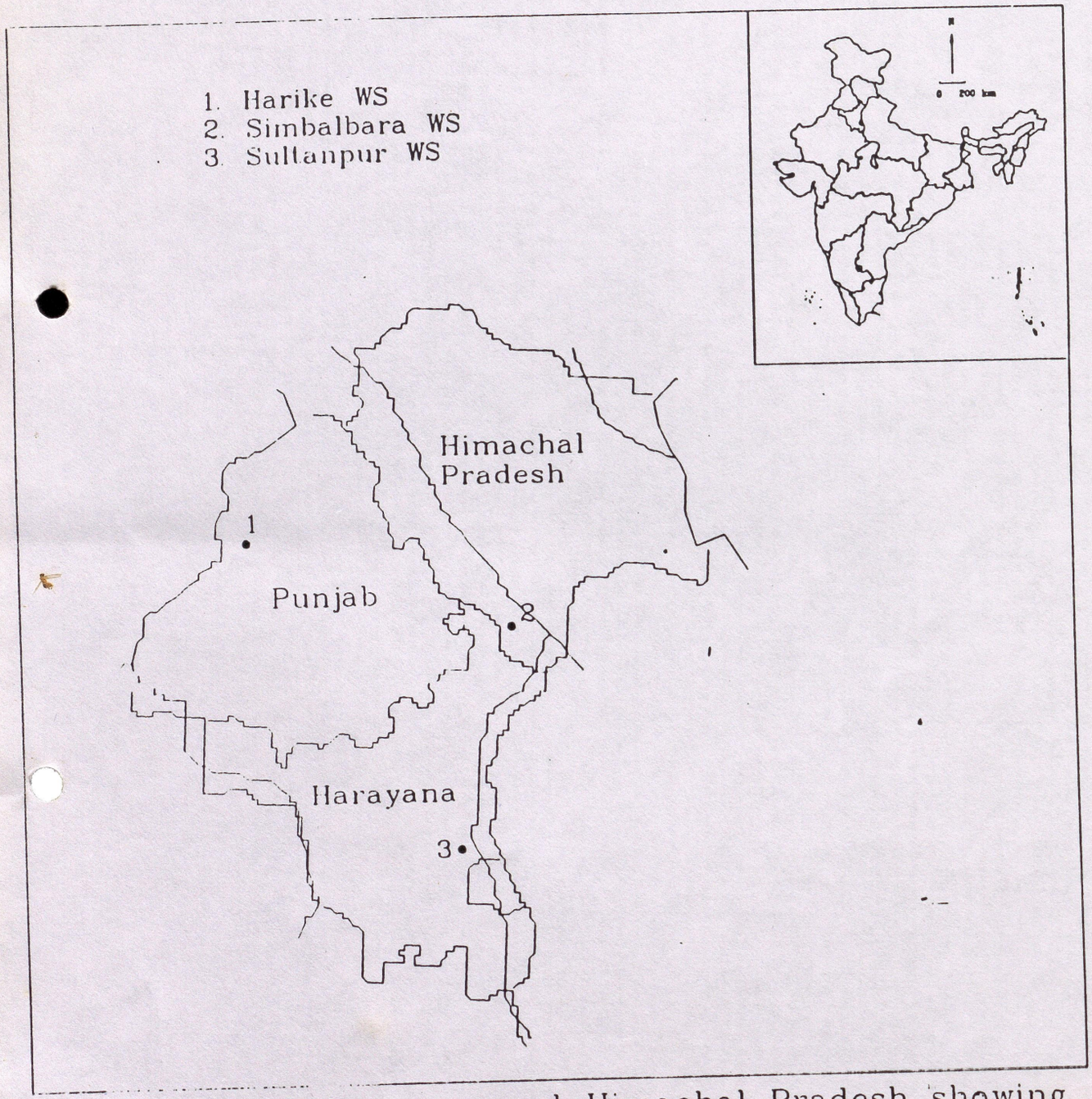


Fig. 15 Punjab, Harayana and Himachal Pradesh showing survey localities

6. JAMMU AND KASHMIR

Sixteen PA have been identified in this state. The southern part (Jammu) is Semiarid (IV) and has no PA. A status report for turtles is available (Duda and Shahi 1977). This state was not included in the present survey due to unstable political situation. Seven species of freshwater turtles have reported from Jammu (Duda and Shahi 1977). No tortoises have been reported from this state. *Lissemys punctata*, *Aspideretes gangeticus*, *Kachuga tecta* and *K. smithii* were reported to be common and the remaining three species were rare **(Table 21)**. A study on the reproductive behaviour of larger softshell turtles is suggested to identify changes, if any, in the reproductive cycles of these species that survive in the northernmost portion of their distribution.

Table 21. Turtle status and Action Plan: Jammu and Kashmir*

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Spotted pond turtle, *Geoclemys hamiltonii*	Rare				
2	Crowned river turtle, *Hardella thurjii*	Rare				
3	Brown roofed turtle, *Kachuga smithii*	Common				
4	Indian roofed turtle, *K. tecta*	Common				
5	Indian softshell turtle, *Aspideretes gangeticus*	Common				Required
6	Narrow-headed softshell turtle, *Chitra indica*	Rare				Required
7	Indian flapshell turtle, *Lissemys punctata*	Common				

* Based on Duda & Sahi (1977)

7. KARNATAKA

Karnataka has three biogeographic zones namely Western Ghats (V), Deccan Peninsula (VI) and Coast (VIII).Twenty four PA have been identified in Karnataka by Rodgers and Panwar (1988). Two PA namely Saravathi and Mookambika WLS and two unprotected areas; Neria RF and Thungabadra river near Shimoga were surveyed during the present study **(Fig. 16)**.

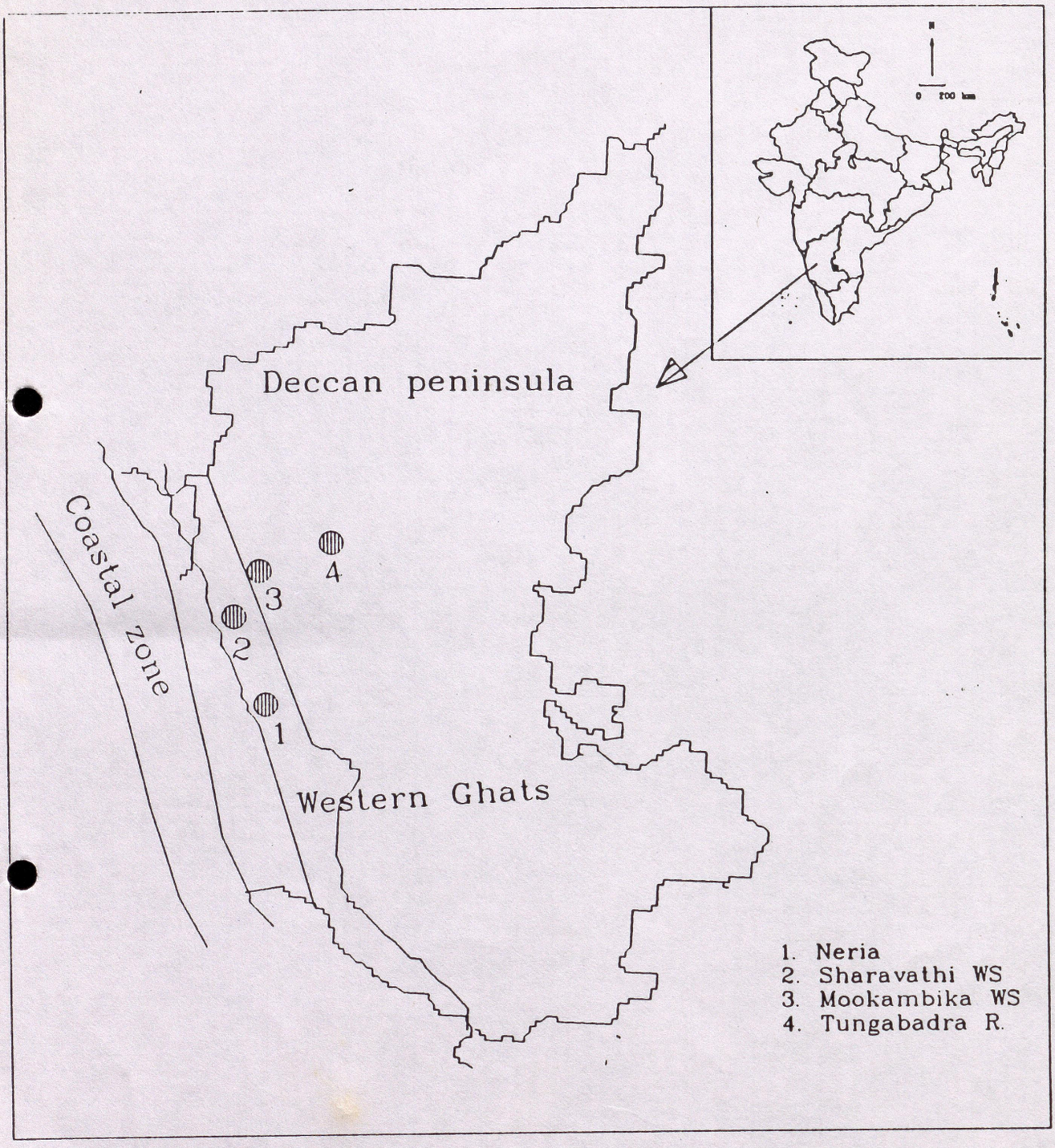


Fig.16 Karnataka showing turtle survey localities

All WS → WLS

Six species of freshwater turtles and land tortoises were recorded during the present survey. *Geoemyda silvatica*, *Indotestudo forstenii* and *Aspideretes leithii* were rare **(Table 22)**. *Lissemys punctata* and *Melanochelys trijuga* were common. The former two species were distributed only in the Western Ghats. *Chitra indica* was recorded in the river Tungabadra in Andhra Pradesh bordering Karnataka. Hence, its presence in Karnataka (parts of Tungabadra) is not ruled out. Intensive survey is suggested for this species **(Table 22)**. *G. silvatica* and *I. forstenii* are known only from a few localities of the Western Ghats. Surveys in Kudremukh NP and associated hills of South Canara district is required as these species are rare and endemic to this biogeographic zone. Also, *A. leithii* is known only from a few localities and a survey in Deccan Peninsula of this state may reveal additional localities for this species. A market survey unearthed the existance of an organised trade for *Geochelone elegans* with a trade centre at Bangalore. Tortoises are being collected from the eastern part of this state. Exploitation control is recommended for *G. elegans*.

Table 22. Turtle species status and Action Plan: Karnataka

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Cochin forest cane turtle, *Geoemyda silvatica*	Rare	Required			
2	Indian black turtle, *Melanochelys trijuga*	Common				
3	Indian star tortoise, *Geochelone elegans*	Uncommon		Required		
4	Travancore tortoise, *Indotestudo forstenii*	Rare	Required			
5	Leith's softshell turtle, *Aspideretes leithii*	Rare	Required			
6	Narrow-headed softshell turtle, *Chitra indica*	?	Required			
7	Indian flapshell turtle, *Lissemys punctata*	Common				

8. **KERALA**

Kerala has two biogeographic zones within its political boundaries; Coast (VIII) and Western Ghats (V). Fifteen PA have been recognised and all of them are in the Wetern Ghats biozone. Four PA; Neyyar, Peppara, Peechi-Vazhani and Parambiculam WLS were surveyed during the present study **(Fig. 17)**.

Five species of freshwater turtles and land tortoises have been confirmed in Kerala **(Table 23)**. Of these two species were tortoises; *Indotestudo forstenii* and *Geochelone elegans*. *G. elegans* was reported from Chinnar WLS, which is an additional locality record for this species (Jayson 1993). *Lissemys punctata*) and *G. elegans* were rare in Kerala due to a lack of natural habitats.

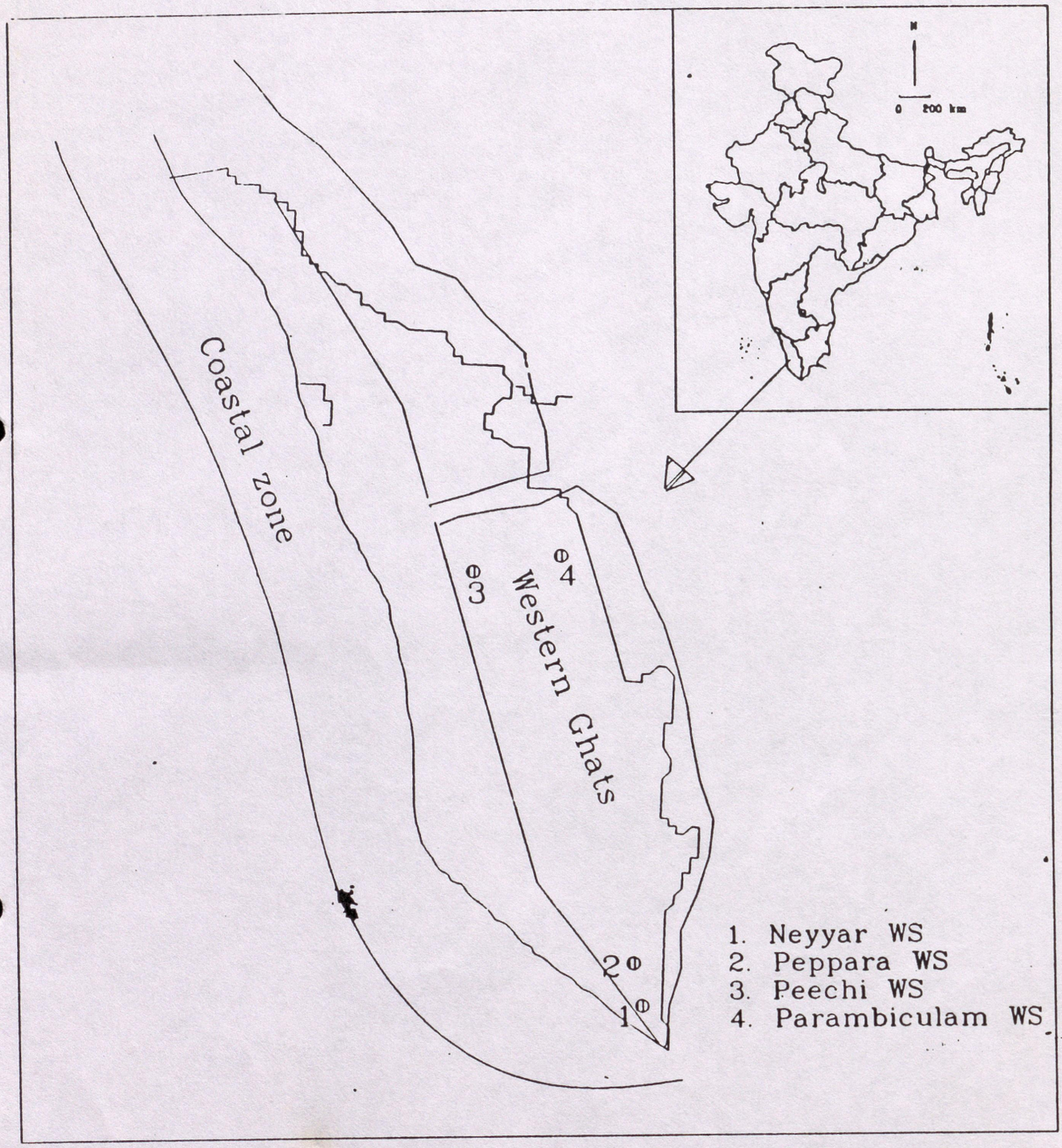


Fig.17 Kerala showing turtle survey localities

All WS ⇒ WLS

The occurrence of *Aspideretes leithii* is suspected in reservoirs of many west- flowing rivers and hence a survey is required. Kerala is a strong hold of endemic species; *I. forstenii* and *Geoemyda silvatica*. Eventhough, these species were comparatively rare, they were wide spread in protected hill forests over the length of Kerala. Further surveys and ecological studies on these endemic species are suggested. The field survey revealed extensive exploitation of *I. forstenii* especially by the tribals inhabiting in and around PA (ie. '*Kadars, Kanis* and *Malyanmar*'). Hence, some sort of exploitation control is needed for *I. forstenii.*

Table 23. Turtle status and Action Plan: Kerala

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Cochin forest cane turtle, *Geomyda silvatica*	Rare	Required			
2	Indian black turtle, *Melanochelys trijuga*	Common				
3	Indian star tortoise, *Geochelone elegans*	Rare				
4	Travancore tortoise, *Indotestudo forstenii*	Uncommon	Required	Required		
5	Leith's softshell turtle, *Aspideretes leithii*	?				
6	Indian flapshell turtle, *Lissemys punctata*	Rare				

9. **MADHYA PRADESH**

Madhya Pradesh (M.P) is one of the largest states in India and also, is one of the most riverine states in the country. Two biogeographic zones; Semiarid (IV) and Deccan Peninsula (VI) and 43 PA have been indentified within the political boundaries of this state. One PA (Chambal WLS) and one unprotected area (70 km stretch of of Narmada river near Narmada Sagar dam) were surveyed during the present study (Fig. 18). This state was surveyed extensively for turtles by Rao (1991) and Moll (1991) and hence not given priority in the present study.

Eleven species of freshwater turtles and land tortoises have been recorded from M.P **(Table 24)**. Two softshells (*Lissemys punctata* and *Aspideretes gangeticus*) and three hard shells (*Kachuga tentoria, K. tecta* and *K.dhongoka*) were common. *Chitra indica* and *K. kachuga* were rare with a restricted distribution especially in the riverine habitats. *Aspideretes hurum* is also rare being recorded only once near Bhopal by (Das 1991). The questionnaire survey of the present study revealed the presence of *Geochelone elegans* in Madhya Pradesh and hence, status assessment of this species is required. *A. leithii* was reported to occur in the southern M.P. (Das 1991). Further surveys are required to acertain the status of this species. Also, *C. indica* was found to be common in the river Mahanadi of Orissa. However, the status of this species other than the Chambal river in M. P. is not known. Hence, turtle surveys in south and eastern parts of this state are required. A captive breeding programme for large hardshells (*K.*

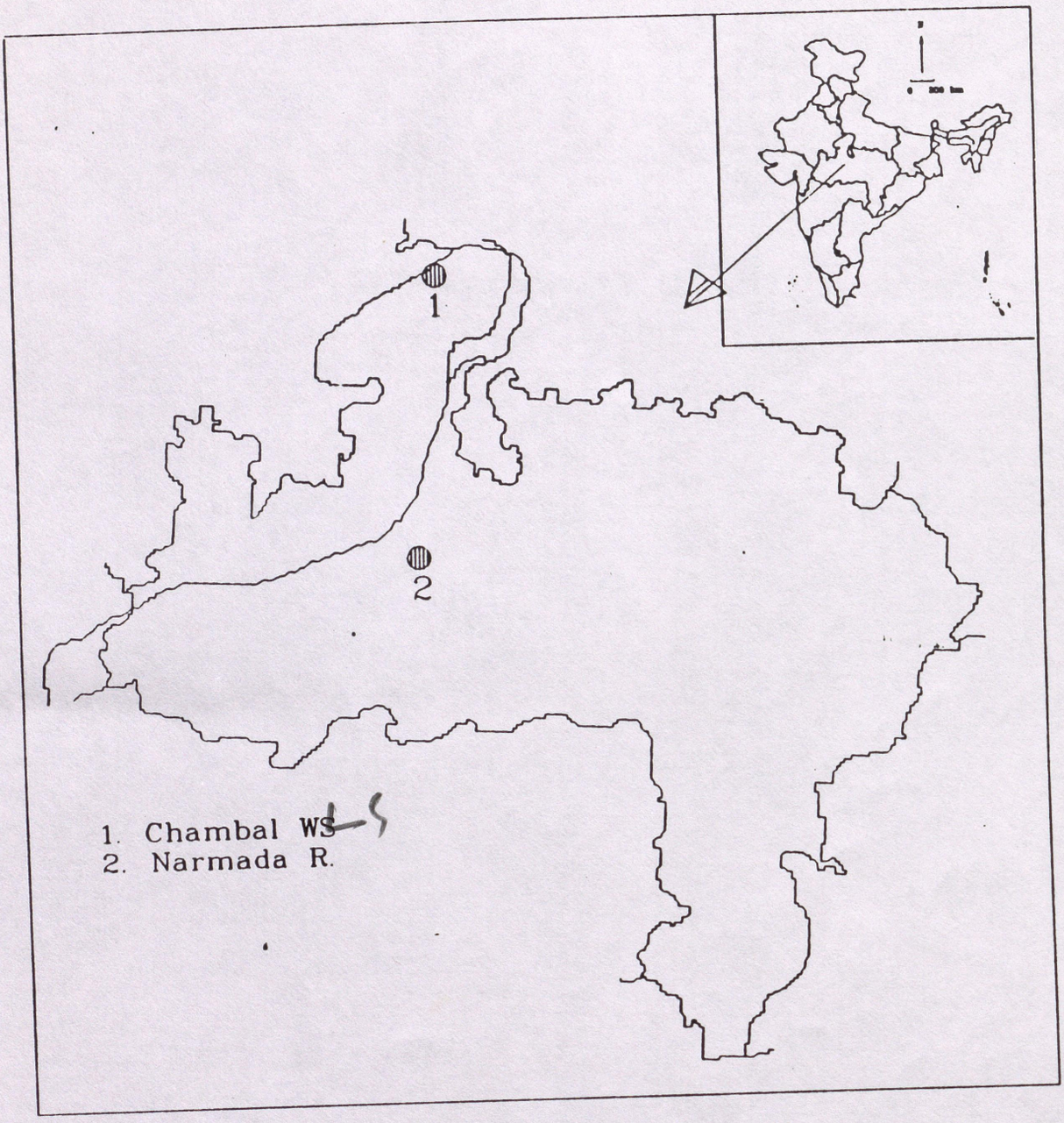


Fig. 18 Madhya Pradesh showing turtle survey localities

dhongoka, K. kachuga) and softshells (*C. indica*) exists in Morena. This programme may be continued as these species are rare in this state and elsewhere also.

Table 24. Turtle status and Action Plan: Madhya Pradesh

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Crowned river turtle, *Hardella thurjii*	Rare				
2	Three-striped roofed turtle, *Kachuga dhongoka*	Common				Required
3	Red-crowned roofed turtle, *K. kachuga*	Rare				Required
4	Indian roofed turtle, *K. tecta*	Common				
5	Indian tent turtle, *K. tentoria*	Common				
6	Indian star tortoise, *Geochelone elegans*	Rare	Required			
7	Indian softshell turtle, *Aspideretes gangeticus*	Common				
8	Indian peacock softshell turtle, *A.hurum*	Rare				
9	Leith's softshell turtle, *A. leithii*	Rare	Required			
10	Narrowheaded softshell turtle, *Chitra indica*	Rare	Required			Required
11	Indian flapshell turtle, *Lissemys punctata*	Common				

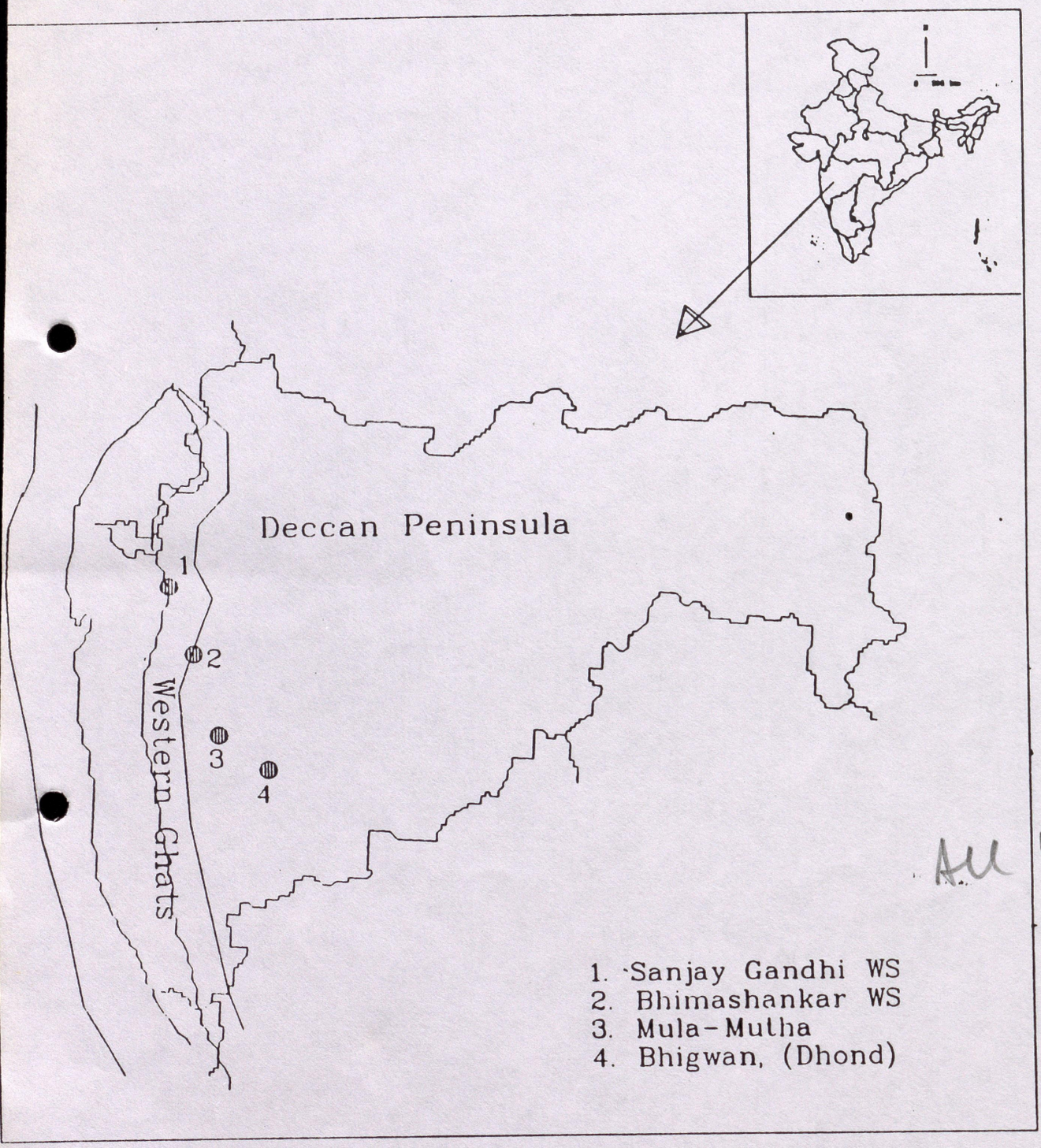
Note: * Das 1991

10. **MAHARASTRA**

Three biogeographic zones namely Wetern Ghats (V), Deccan Peninsula (VI), and Coast (VIII) have been recognised by Rodgers and Panwar (1988). Thirty PA are available in this state and four localities have been surveyed by this project. They include two PA; Bhimasankar WLS and Sanjay Gandhi WLS/NP and two unprotected area namely, Mula-Mutha, Pune and Bhigwan near Dhond **(Fig. 19)**.

Seven species of freshwater turtles and land tortoises have been confirmed within the boundaries of Maharastra **(Table 25)**. *Geoemyda silvatica* and *Indotestudo forstenii* may also occur in the Western Ghats of Maharastra especially in the southwestern parts as these species were recorded in Neria RF and Dandeli WLS, Karnataka respectively. The record of *Aspideretes hurum* near Poona (Varghese and Tonapi 1986) needs confirmation.

Intensive surveys are required to assess the status of the above mentioned species. *Geochelone elegans* was reported to be distributed on the southeastern parts of this state (Questionnaire survey) but appears



All WS → WLS

Fig.19 Maharashtra showing turtle survey localities

to be rare. *Chitra indica* was found to be uncommon in Bhigwan (Bhima river). Identification of more strong holds for these species in this state is required. *A. leithii* and *Lissemys punctata* were common in Maharastra. All hardshell (emydid) species were rare and they have very few records in this state. The wetlands nearby Bhigwan (Dhond and Poona) contain three softshell turtles of which *C. indica* is an endangered species. Inhabitants of the Bhigwan area informed us that *C. indica* is common there. As this species is rare in most parts of its distribution, this area has potential as a sanctuary and captive breeding of large softshells may be considered here for restocking. Also, many locals consume large softshells and public awareness campaigns and exploitation control is required.

Table 25. Turtle Status and Action Plan: Maharastra

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Cochin forest cane turtle, *Geoemyda silvatica*	?	Required			
2	Indian roofed turtle, *Kachuga tecta*	Rare				
3	Indian tent turtle, *K. tentoria*	Rare				
4	Indian black turtle, *Melanochelys trijuga*	Rare				
5	Indian star tortoise, *Geochelone elegans*	Rare	Required			
6	Travancore tortoise, *Indotestudo forstenii*	?	Required			
7	Indian peacock softshell turtle, *Aspideretes hurum*	??	Required			
8	Leith's softshell turtle, *A.leithii*	Common			Required	Required
9	Narrow-headed softshell turtle, *Chitra indica*	Rare	Required	Required	Required	Required
10	Indian flapshell turtle, *Lissemys punctata*	Common				

11. NORTHEASTERN INDIA

Northeast India (NEI) consists of seven states; Arunachal Pradesh, Assam, Meghalaya, Manipur, Nagaland, Tiripura and Mizoram. Due to paucity of data on turtles, all of these states were taken as one in the present study. Three biogeographic zones have been recognised in NEI; Himalayas (II), Coast (VIII) and Northeast India (IX) by Rodgers and Panwar (1988). A total of 38 PA have been identified in NEI of which nine have been suveyed. Only Assam and Arunachal Pradesh were covered extensively during the present study **(Fig. 20)**. Meghalaya was surveyed for turtles in recent years by Das (1990).

Nineteen species of freshwater turtles and land tortoises were reported in Northeastern India (Smith 1933, Das 1990 and the present survey, **Table 26**). The occurrence of *Kachuga dhongoka* and *Morenia petersi* in Northeast India (Smith 1933) is doubtful as all records for these species were over 20 years old. A survey is needed for these species. The present study added *Aspideretes gangeticus* and *Chitra indica*

to the faunal list of NEI. The distribution pattern of these species in NEI is not clearly known and hence, a survey is suggested. Except for the tortoises, most species were common. During the present survey, *Manouria emys* and *Indotestudo elongata* were found only in the Southern NEI (ie. North Cachar hills, Assam, Dampha WLS, Mizoram, Nitin D. Rai, Pers. Comm. and Das 1990). Further surveys are suggested for *M. emys* as this species has very few records in India. Two large hardshells *Geoclemys hamiltonii* and *Hardella thurjii* and three small riverine hardshells (*Kachuga smithii, K. tecta*, and *K. tentoria*) are common in NEI (see Chapter IV). *K. sylhetensis* is rare in NEI and is represented by only a few specimens in the museums. As it has very few locality records, intensive survey is indicated for this species. All softshell turtle species were exploitated commercially and *Manouria emys* was hunted severely by the tribal inhabitants. Exploitation control is suggested for the tortoise and large softshells. The Mupa-Lanteng RF in the North Cachar Hills could be elevated to a Sanctuary status to protect turtle species inhabiting the forest floor ie.*Pyxedia mouhotii*, *Cyclemys dentata* and *Manouria emys*. *M.emys* is rare in India and it is distributed only in the southern part of the NEI. A captive breeding unit for *M. emys* is suggested in Meibang, North Cachar Hills in Assam.

Table 26. Turtle status and Action Plan: Northeast India

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Malayan box turtle, *Cuora amboinensis*	Common				
2	Asian leaf turtle, *Cyclemys dentata*	Common				
3	Spotted pond turtle *Geoclemys hamiltonii*	Common				
4	Crowned river turtle, *Hardella thurjii*	Common				
5	Three-striped roofed turtle, *Kachuga dhongoka*	?	Required			
6	Brown roofed turtle, *K. smithii*	Common				
7	Assam roofed turtle, *K.sylhetensis*	Rare	Required			
8	Indian roofed turtle, *K. tecta*	Common				
9	Indian tent turtle, *K. tentoria*	Common				
10	Tricarinate hill turtle, *Melanochelys tricarinata*	Un-common				
11	Indian black turtle, *M.trijuga*	Rare				
12	Indian eyed turtle, *Morenia petersi*	?	Required			
13	Keeled box turtle, *Pyxidea mouhotii*	Un-common				
14	Elongated tortoise, *Indotestudo elongata*	Rare				
15	Asian brown tortoise, *Manouria emys*	Rare	Required	Required	Required	Required
16	Indian softshell turtle, *Aspideretes gangeticus*	Un-Common		Required		
17	Indian peacock softshell turtle, *Aspideretes hurum*	Common		Required		
18	Narrow-headed softshell turtle, *Chitra indica*	Rare		Required		
19	Indian flapshell turtle, *Lissemys punctata*	Rare				

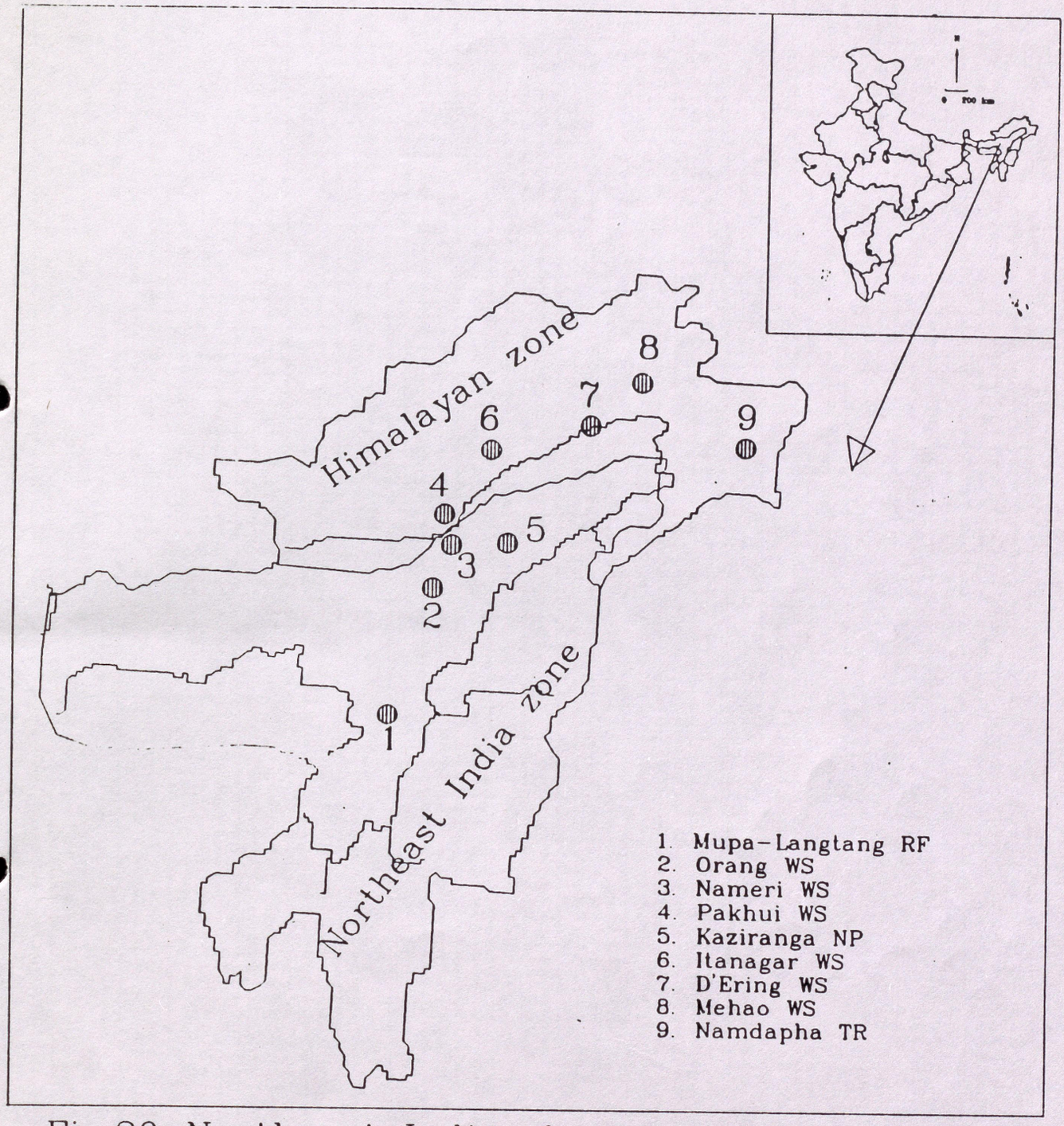


Fig.20 Northeast India showing survey localities

All WS → WLS

12. **ORISSA**

The state Orissa has three bigeogeographic zones namely, the Deccan Peninsula (VI), Gangetic Plains (VII) and Coast (VIII). Nineteen PA have been itentified in this state by Rodgers and Panwar (1988). During the present study three localities namely, Lakhari Valley, Bhittarkanika WLS and Mahanadi near Cuttack (ie. unprotected area) were surveyed **(Fig. 21)**. The occurrence of 10 turtle species have been confirmed in Orissa **(Table 27)**. Three softshell species; *A. gangeticus, Chitra indica* and *Lissemys punctata* and one hardshell (*Kachuga tentoria*) were common. *A. leithii* may occur in south and southwestern parts of Orissa (Moll and Vijaya 1986) but this needs confirmation.

Table 27. Turtle status and Action Plan: Orissa

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	River terrapin, *Batagur baska* *	??				
2	Indian roofed turtle, *Kachuga tecta*	Rare				
3	Indian tent turtle, *K. tentoria*	Common				
4	Indian star tortoise, *Geochelone elegans*	Rare				
5	Elongated tortoise, *Indotestudo elongata*	Rare				
6	Indian softshell turtle, *Aspideretes gangeticus*	Common		Required	Required	required
7	Indian Peacock softshell turtle, *A.hurum*	Rare			Required	Required
8	Leith's softshell turtle, *A.leithii*	?	Required			
9	Narrow-headed softshell turtle, *Chitra indica*	Common		Required	Required	Required
10	Asian giant softshell turtle, *Pelochelys cantorii*	Rare	Required		Required	Required
11	Indian flapshell turtle, *Lissemys punctata*	Common				

Note: * Smith (1931)

Pelochelys cantorii is distributed in the esturine parts of this state which has been found in the backwaters of Balassore coast (Moll and Vijaya, 1986). Another esturine species *Batagur baska* appears to be locally extinct as there have been no confirmed reports for the PAt 20+ years. Exploitation control for large softshell turtles is suggested as they are extensively used by locals and are sent to Calcutta markets (Choudhury and Bhupathy 1993). Backwaters and coastal wetlands near Balassore should be be considered for a sanctuary for the rare and endangered *P. cantorii.* The Mahanadi river near Mundali, Cuttack has the potential for a river turtle sanctuary as this area has many softshell species. Also, this locality has the potential for a captive breeding centre for larger softshell turtles such as *Chitra indica, Aspiderestes gangeticus* and *A. hurum.*

All WS → WLS

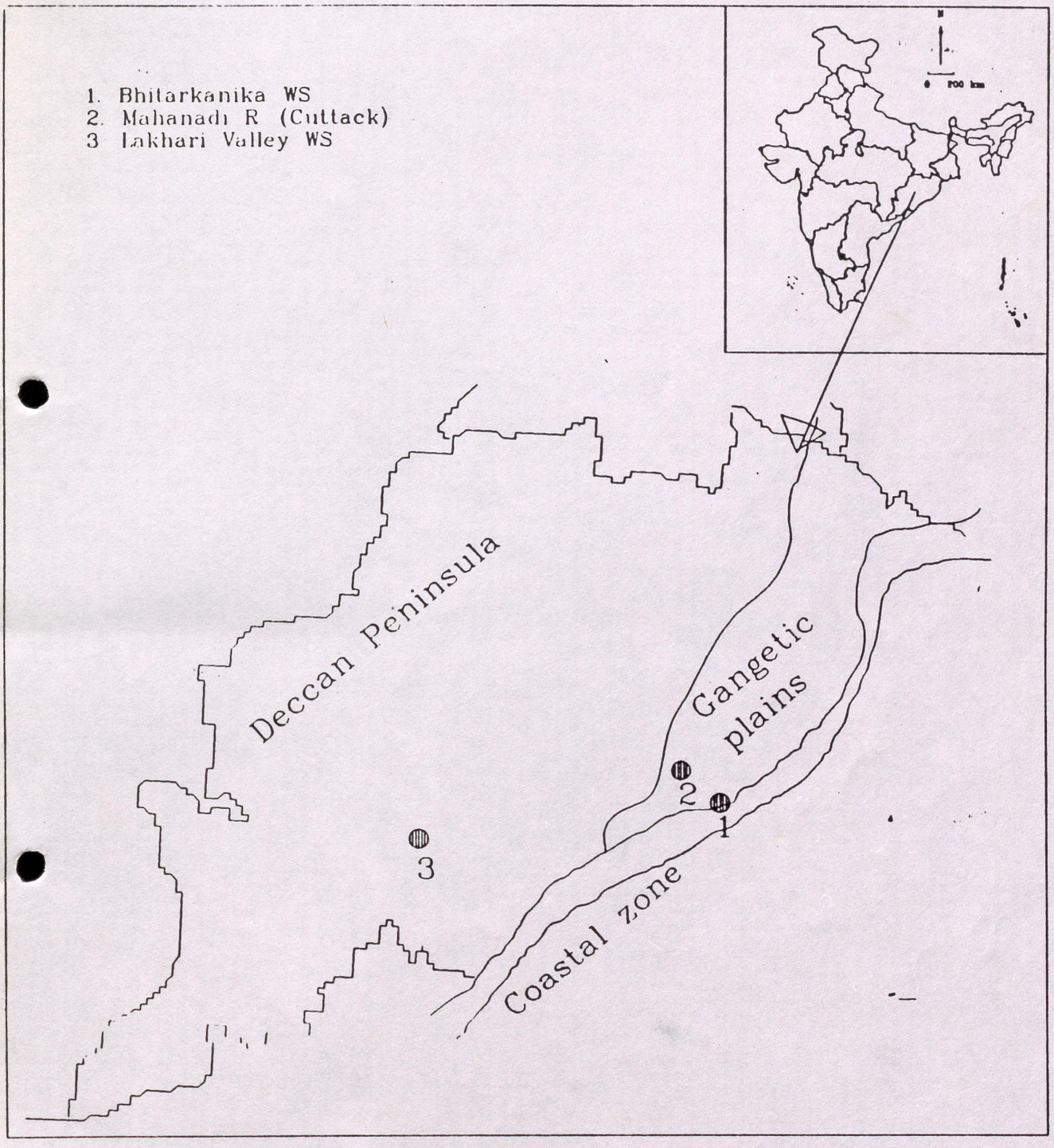


Fig.21 Orissa showing turtle survey localities

13. **PUNJAB**

The state Punjab has only one biogeographic zone, the Semiarid zone (IV). This state is on the flood plains of Indus river system. Five PA have been recognised by Rodgers and Panwar (1988). Only one PA (Harike WLS) was surveyed in the present study **(Fig. 15)**. Seven species of freshwater turtles have been confirmed in Punjab **(Table 28)**. All hardshell species were common in the riverine stretches of this state especially in the Northwest. Harike WLS is a potential site for chelonian conservation in this state. There are unconfirmed reports of *Geochelone elegans* in this state but, this could not be confirmed during the present field surveys. A field survey is suggested to acertain the presence and status of this species. Captive breeding for larger softshell turtles is suggested.

Table 28. Turtle status and Action Plan: Punjab

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Spotted pond turtle, *Geoclemys hamiltonii*	Common				
2	Crowned river turtle, *Hardella thurjii*	Common				
3	Brown roofed turtle, *Kachuga smithii*	Common				
4	Indian roofed turtle, *K. tecta*	Common				
5	Indian star tortoise, *Geochelone elegans*	Rare ?	Required			
6	Indian softshell turtle, *Aspideretes gangeticus*	Rare				Required
7	Narrow-headed softshell turtle, *Chitra indica*	Rare				Required
8	Indian flapshell turtle, *Lissemys punctata*	Common				

14. **RAJASTHAN**

This state has two biogeographic zones; Indian Desert (III) and Semiarid (IV) within its political boundaries (Rodgers and Panwar 1988). Twenty-six PA have been identified in this state. Barring a visit to the Keoladeo National Park, Bharatpur, no survey was carried out in Rajasthan **(Fig. 22)** because of extensive turtle surveys in recent years by Bhupathy and Vijayan (1991). Eleven species of freshwater turtles and land tortoises have been confirmed in Rajasthan (Bhupathy and Vijayan 1991) and their status is given in **Table 29**. Many (riverine) species were present in Rajasthan but were rare because the state lies in the Western boundaries of turtle-rich Gangetic Plains (Yamuna and Chambal rivers). Only *Kachuga tecta* and softshells such as *Lissemys punctata* and *Aspideretes gangeticus* were common. Other species were rare because of lack of suitable habitats in the arid and semiarid parts of this state. Rajasthan is one of

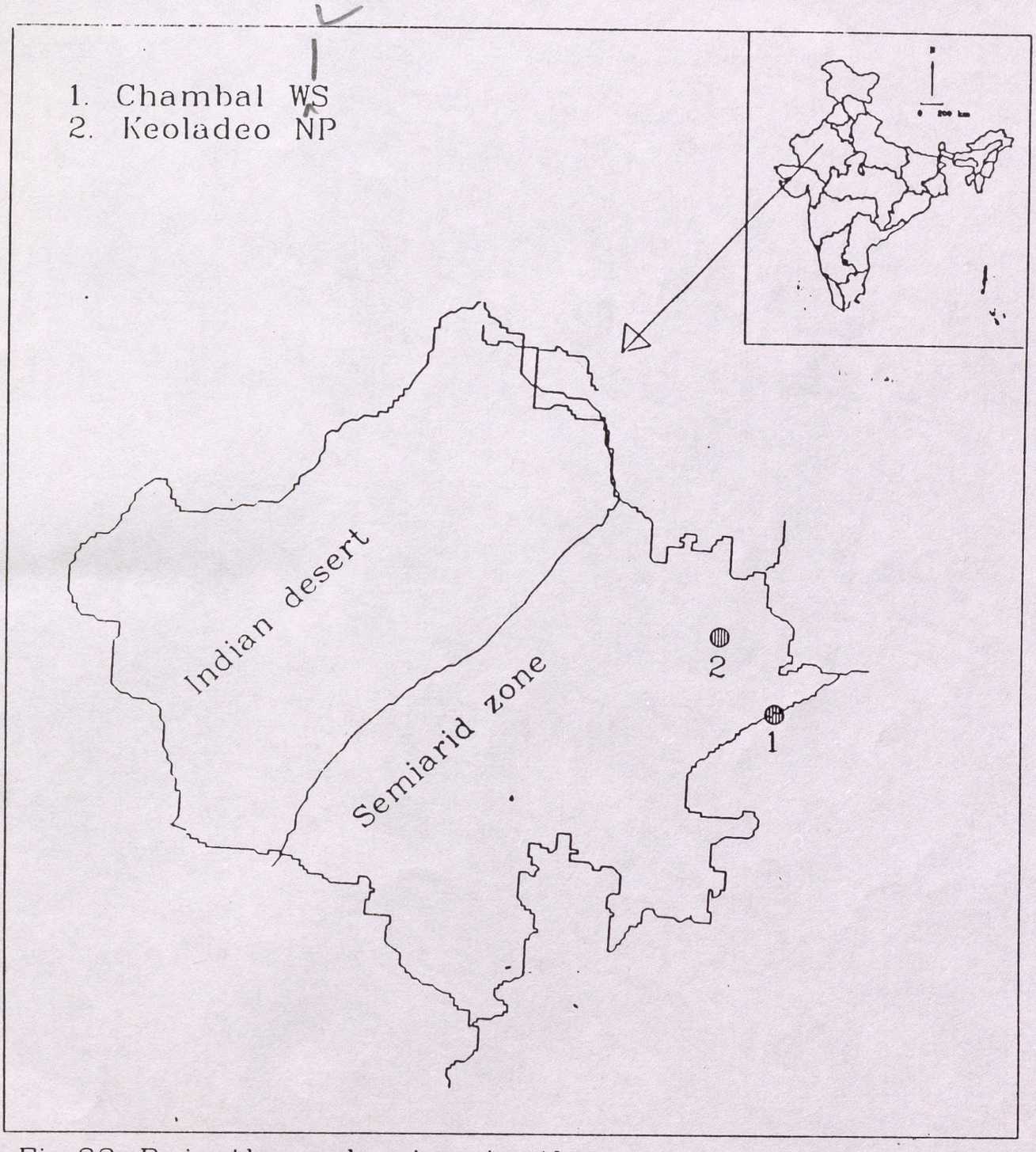


Fig.22 Rajasthan showing turtle survey localities

the the main collection centres for commercial exploitation of *Geochelone elegans* (Choudhury and Bhupathy 1993). Exploitation control is suggested for this species.

Table 29. Turtle status and Action Plan: Rajasthan*

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Spotted pond turtle, *Geoclemys hamiltonii*	Rare				
2	Crowned river turtle, *Hardella thurjii*	Rare				
3	Three-striped roofed turtle, *K. dhongoka*	Rare				
4	Red-crowned roofed turtle, *K. kachuga*	Rare				
5	Indian roofed turtle, *K. tecta*	Common				
6	Indian tent turtle, *Kachuga tentoria*	Rare				
7	Indian star tortoise, *Geochelone elegans*	Uncommon		Required		
8	Indian softshell turtle, *Aspideretes gangeticus*	Common				
9	Indian peacock softshell turtle, *A.hurum*	Rare				
10	Narrow-headed softshell turtle, *Chitra indica*	Rare				
11	Indian flapshell turtle, *Lissemys punctata*	Common				

* Bhupathy and Vijayan (1991)

15. **TAMIL NADU**

Tamil Nadu has three biogeographic zones; Western Ghats (V), Deccan Peninsula (VI) and Coast (VIII) within its political boundaries. Rodgers and Panwar (1988) have identified seventeen PA in the state. Four PA and one unprotected area were surveyed during the present study **(Fig. 23)**. Turtle records in other parts of Tamil Nadu in recent years (Kalaiarasan et al 1992.) were also considered here. Five species of freshwater and one land species have been recorded from Tamil Nadu. *Geoemyda silvatica* and *Indotestudo forstenii* were distributed only in the Western Ghats, both species were rare and sparsely distributed (See Chapter IV, Sec. Westren Ghats, **Table 30**). Agasthiyamalai and Anaimalai are important conservation areas for these species. Kothaiyar RF, the southern part of the Agasthiyamali is proposed for inclusion in the PA network. Three species (one tortoise, one hardshell and one softshell species) were common in Tamil Nadu **(Table 30)**. *Aspideretes leithi* is rare in the southern parts of its distribution. Further surveys are required to acertain the status of this species in Tamil Nadu. This species was recorded in the Cauveri river in the plains of this state (Kalaiyarasan et al 1992) and Amaravathi river, a tributory of Cauvery river (Maoll and Vijaya 1986). *Indotestudo forstenii* was exploited by the inhabitatns at Kothaiyar RF and Indira Gandhi WLS. Exploitation control is suggested.

All WS → WLS

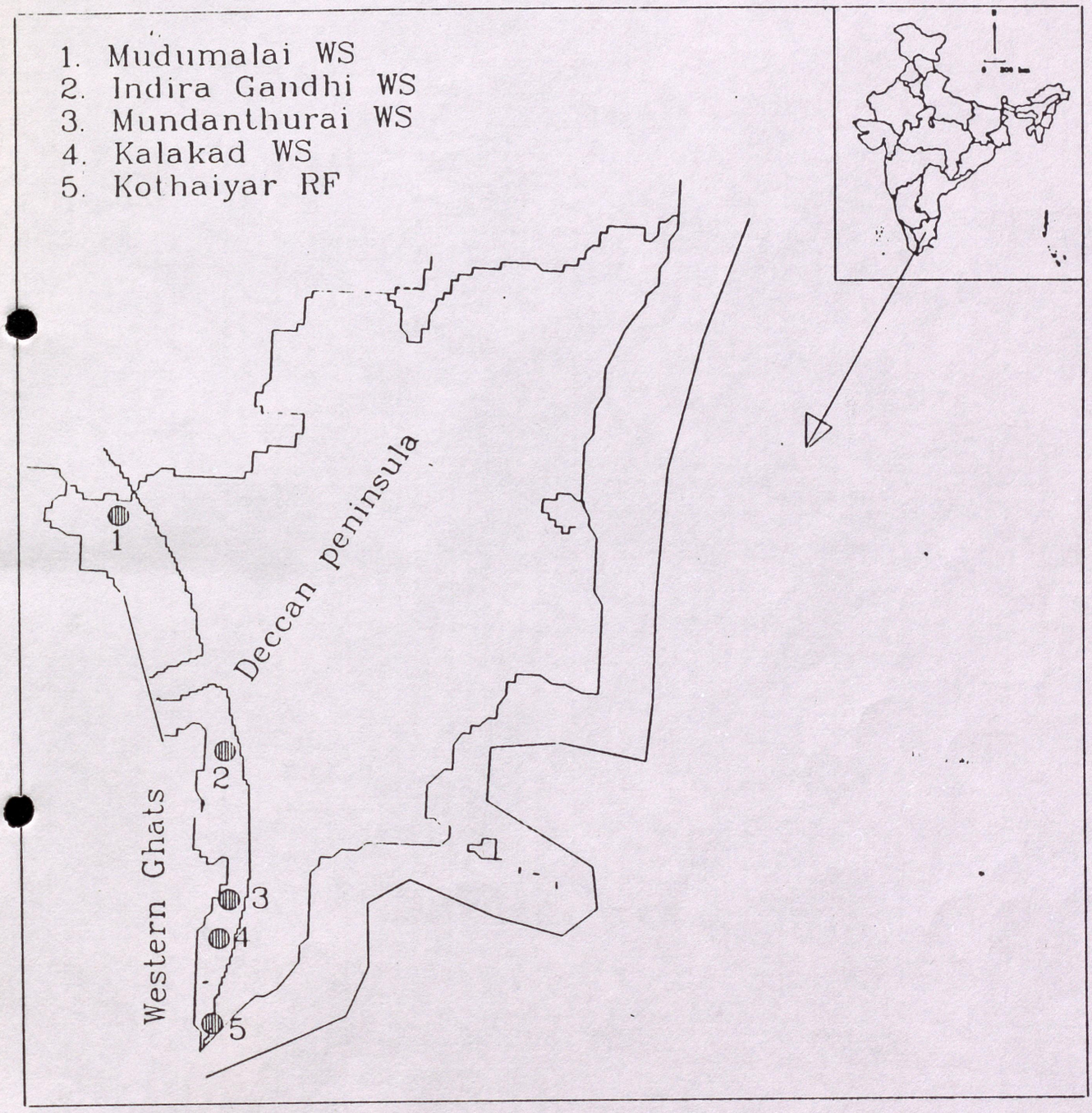


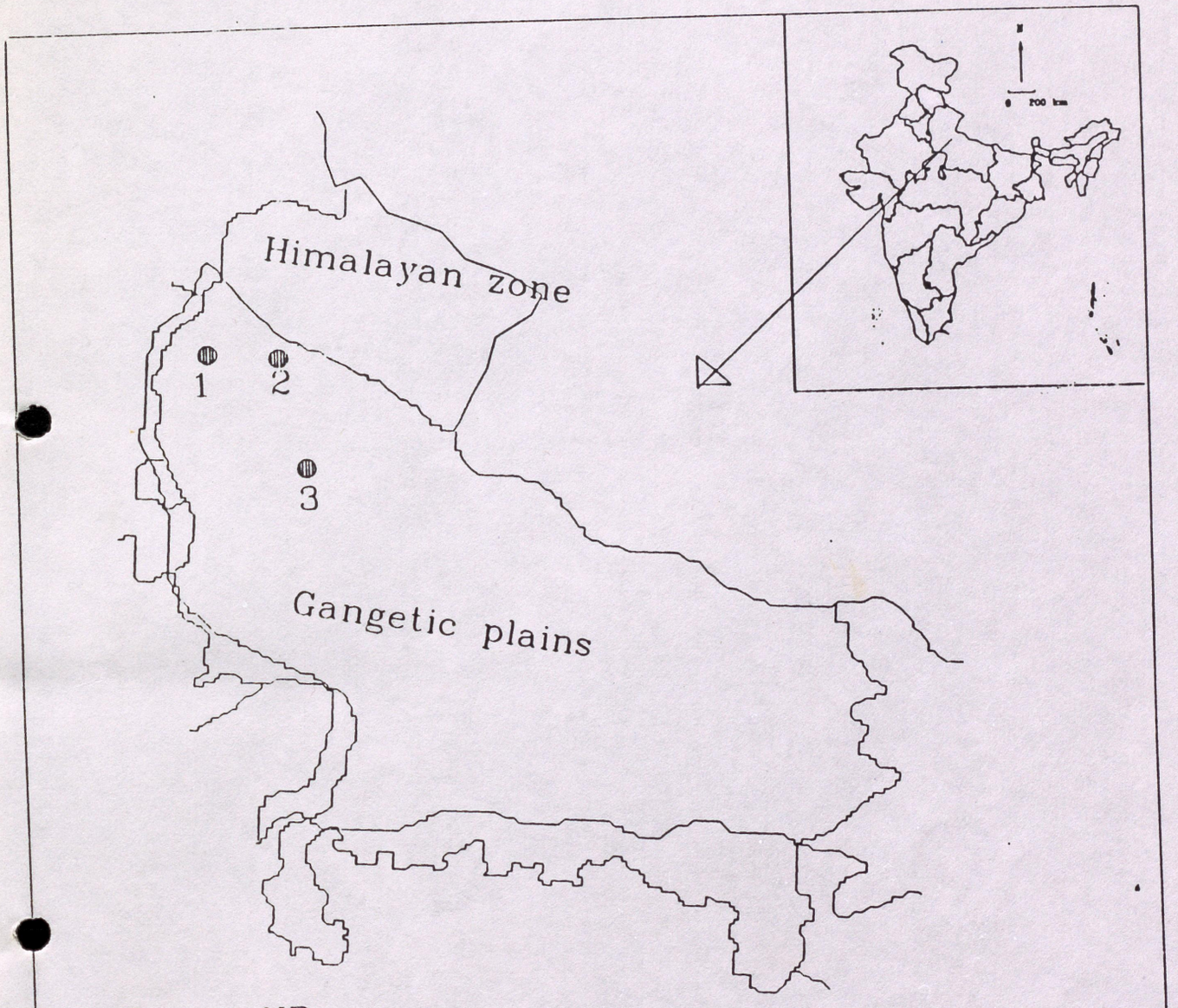
Fig.23 Tamil Nadu showing turtle survey localities

Table 30. Turtles status and Action Plan: Tamil Nadu

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	Cochin forest cane turtle, *Geoemyda silvatica*	Rare	Required		Required	
2	Indian black turtle, *Melanochelys trijuga*	Common				
3	Indian star tortoise, *Geochelone elegans*	Common				
4	Travancore tortoise, *Indotestudo forstenii*	Rare	Required	Required	Required	
5	Leith's softshell turtle, *Aspideretes leithii*	Rare	Required			
6	Indian flapshell turtle, *Lissemys punctata*	Common				

16. **UTTAR PRADESH**

The state Uttar Pradesh (U.P.) has four biogeographic zones; Himalayas (II), Semiarid (IV), Deccan Peninsula (VI) and Gangetic Plains (VII) within its political boundaries. Thirty five PA have been identified in this state by Rodgers and Panwar (1988). U.P. was extensively surveyed for turtles by other workers in recent years (Moll 1986, 1987, 1991). Hence, this state was not given priority in the present study **(Fig. 24)**. Also, this state have many Turtle Conservation Programmes. Fourteen species of freshwater turtles and tortoises have been confirmed from U.P. **(Table 31)**. The smaller hardshells of the genus *Kachuga* and *Melanochelys* were common. Softshell species such as *Aspideretes gangeticus* and *Lissemys punctata* were also common. Larger hardshells and other softshells were rare. The presence of *Morenia petersii* in U.P was confirmed in Dudwa National Park (Javid and Hanfi 1995). However, its occurrence in other localities is to be confimed. Only a few locality records are available for *K. kachuga* and *Geoclemys hamiltonii* . Hence, further intensive status surveys are required for *M. petersii, Geoclemys hamiltonii* and *K. kachuga*. Larger softshell turtles namely, *A. gangeticus, A. hurum* and *C. indica* were reportedly sent to the Calcutta markets (Choudhury and Bhupathy 1993). As species such as *C. indica* was rare throughout its range, exploitation control is suggested. Large riverine hardshells such as *K. kachuga and K. K. dhongoka* were rare thoughout their range. These species may be captive bred for restocking in localities from where they were recorded earlier. The captive breeding of these may be initiated in the already existing turtle breeding facilities at Kukrail, Lucknow.



1. Rajaji NP
2. Corbett NP
3. Ganges (Narora)

Fig.24 Uttar Pradesh showing turtle survey localities

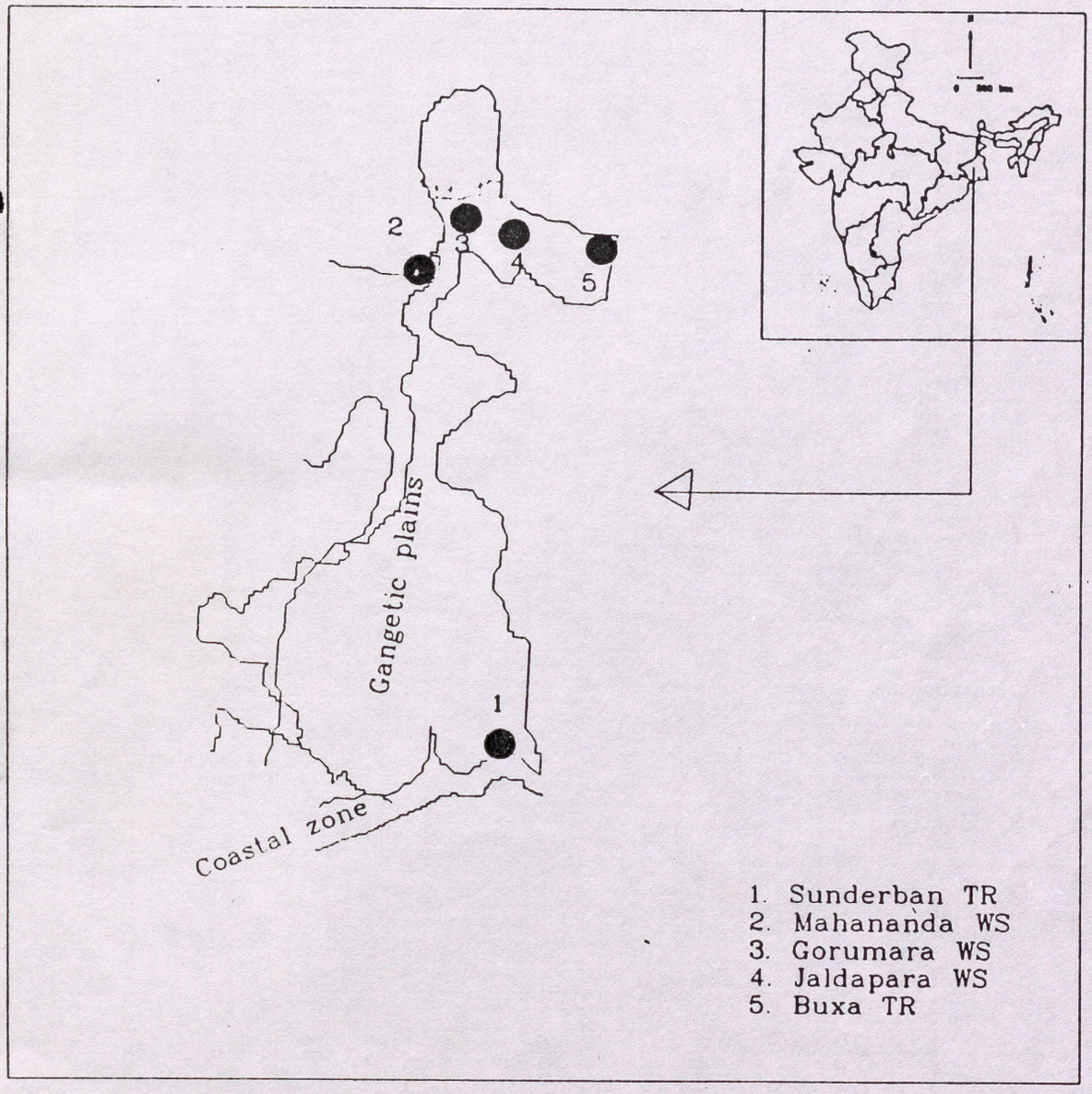
Table 31. Turtle species status and Action Plan: Uttar Pradesh

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA proposed	Captive breeding
1	Spotted pond turtle, *Geoclemys hamiltonii*	Rare	Required			
2	Crowned river turtle, *Hardella thurjii*	Uncommon				
3	Three-striped roofed turtle, *Kachuga dhongoka*	Rare				Required
4	Red-crowned roofed turtle, *K. kachuga*	Rare	Required			Required
5	Brown roofed turtle, *K. smithii*	Common				
6	Indian roofed turtle, *K. tecta*	Common				
7	Indian tent turtle, *K.tentoria*	Common				
8	Tricarinate hill turtle, *Melanochelys tricarinata*	Common				
9	Indian black turtle, *M. trijuga*	Common				
10	Indian eyed turtle, *Morenia petersi*	Rare	Required			
11	Elongated tortoise, *Indotestudo elongata*	Rare				
12	Indian softshell turtle, *Aspideretes gangeticus*	Common		Required		
13	Indian peacock softshell turtle, *A.hurum*	Rare		Required		
14	Narrow-headed softshell turtle, *Chitra indica*	Rare		Required		
15	Indian flapshell turtle, *Lissemys punctata*	Common				

17. **WEST BENGAL**

West Bengal has three biogeographic zones; Himalayas (II), Gangetic Plains (VII) and Coast (VIII). Twenty PA have been identified in this state by Rodgers and Panwar (1988). Five PA namely the Sunderban TR, Mahananda, Gorumara, Jaldapara WLS and Buxa TR have been surveyed during the present study **(Fig. 25)**. Including the record of *Kachuga sylhetensis* (**Das 1997**), nineteen species of freshwater turtles and land tortoises have been reported so far from this state **(Table 32)**. This state has the highest number of turtle species among Indian states. This is mainly because of highest habitat diversity ie. coast, rivers, flood plains, ponds and reservoirs and foothill forests. Also, this state forms the link between Indian main land and Indomalayan and Indochinese faunal regions. Many species found in this state were rare; all reverine hardshells (*Kachuga* spp.), all but one of the softshell turtles (ie. *Lissemys punctata)* were rare **(Table 32)**. Notable among the rare species were *Batagur baska*, *Morenia petersi* and *P. cantorii* which survive in the Indian Sunderbans.

In recent years records of the species such as *K. kachuga* , *K. dhongoka* and *M. petersi* were few. An intensive survey is immediately needed to acertain the status of these species. Rarity of many freshwater turtles in this state could be mainly due to the organised trade. All larger hardshells and softshell have been exploited commercially in recent years (Moll 1991, Choudhury and Bhupathy 1993). Hence,



All WS → WLS

Fig.25 West Bengal showing turtle survey localities

exploitation control is recommended for all softshell turtle species. *B.baska* is rare throughout its range in southeast Asia and only a small poulation thrives within India Sunderbans. Captive breeding of this species is urgently needed to save it from local extinction.

Table 32. Turtle status and Action Plan: West Bengal

No.	Species	Status	Action plan			
			Further survey	Exploitation control	PA Proposed	Captive breeding
1	River terrapin *Batagur baska*	Rare				Required
2	Asian leaf turtle, *Cyclemys dentata*	Common				
3	Spotted pond turtle, *Geoclemys hamiltonii*	Rare				
4	Crowned river turtle, *Hardella thurjii*	Rare				
5	Three-striped roofed turtle, *Kachuga dhongoka*	Rare	Required			
6	Red-crowned roofed turtle, *K. kachuga*	Rare	Required			
7	Brown roofed turtle, *K. smithii*	Rare				
8	Assam roofed turtle, *K. sylhetensis* *	Rare	Required			
9	Indian roofed turtle, *K. tecta*	Uncommon				
10	Indian tent turtle, *K.tentoria*	Uncommon				
11	Tricarinate hill turtle, *Melanochelys tricarinata*	Common				
12	Indian black turtle, *M. trijuga*	Common				
13	Indian eyed turtle, *Morenia petersi*	Rare	Required			
14	Elongated tortoise, *Indotestudo elongata*	Un-common		Required		
15	Indian softshell turtle, *Aspideretes gangeticus*	Common		Required		
16	Indian peacock softshell turtle, *A.hurum*	Rare		Required		
17	Narrow-headed softshell turtle, *Chitra indica*	Rare		Required		
18	Indian flapshell turtle, *Lissemys punctata*	Common		Required		
19	Asian giant softshell turtle, *Pelochelys cantorii*	Rare				

* Das (1997)

CHAPTER VII

STATUS ASSIGNMENT OF FRESHWATER TURTLES AND LAND TORTOISES

India has 26 species of freshwater turtles (22) and land tortoises (4) within its political boundaries. The Indian Wildlife (Protection) Act 1972, (Anon 1991), listed 16 species in the Schedules (10 species in Schedule I and 6 in Schedule IV). The updated Red Data Book (1991) included 10 species in the listing and CITES listes 10 species in the Appendices (Appendix I; Stubbs 1991). The existing legal listings of chelonians are based on incomplete and fragmented information on the distribution of turtles. Also, all these listings are mainly based on qualitative population parameters and organised trade. Hence, a new approach is proposed which considers various aspects such as distribution, population, habitat condition and utilization by species, exploitation pressure, food habits and breeding strategy. The method adopted herein is developed from the work of Rabinowitz *et al.* (1986) giving ranks to various factors based on possible impact on the species survival. The present method is more comprehensive and may widely be used. The IUCN is in the process of reevaluating the threatened species categories (Mace and Lande 1991, Mace and Stuart 1994).

DATA BASE

Three sets of data were used for status assignment for turtle species at National level.

- **Primary data:** Results of two and half years field survey covering 62 localities mostly Protected Areas (approximately 10% of the PA network of the country), conducted between October 1991 and July 1993.
- **Secondary data**: results of the questionnaire survey and personal discussion with colleagues working on reptiles regarding the status of turtles in their work area.
- **Tertiary data**: based on museum and literature surveys; specimens of rare turtles were examined in the museums of the Zoological Survey of India (Indian Museum), Calcutta and the Bombay Natural History Society, Mumbai. Recent literature on the chelonian status and distribution were also surveyed (Moll 1984,1986,1987, 1989,1991; Moll and Vijaya 1986, Moll et. al 1986; Das 1990, 1991b; Vyas and Patel 1990; Bhuapthy and Vijayan 1991 and Frazier 1992a, Frazier and Das 1994). Apart from this, 61 daily or weekly fish markets were surveyed all over India for quantifying commercial utilization (Choudhury and Bhupathy 1993). Subsistence use by inhabitants in around 62 localities areas were also considered. Information on the food habits and breeding especially clutch size of the chelonians are extracted from (Smith 1931, Daniel 1983, Das 1991b, Bhupathy and Vijayan 1993, Bhupathy and Choudhury 1994). Information on the habitat use of the turtles and their habitat conditions are mostly gathered during the present work as well as from the above mentioned literature.

Table 33. Distribution of freshwater turtles and land tortoises in different biogeographic zones and states in india

No.	Species	Distribution in	
		No. of biogeographic zones	No. of states
1	River terrapin, *Batagur baska*	1	1
2	Malayan box turtle, *Cuora amboinensis*	2	1
3	Asian leaf turtle, *Cyclemys dentata*	2	2
4	Spotted pond turtle, *Geoclemys hamiltonii*	3	7
5	Forest cane turtle, *Geomyda silvatica*	1	3
6	Crowned river turtle, *Hardella thurjii*	3	8
7	Three-striped roofed turtle, *Kachuga dhongoka*	2	5
8	Red-crowned roofed turtle, *Kachuga kachuga*	2	5
9	Brown roofed turtle, *Kachuga smithii*	3	6
10	Assam roofed turtle, *Kachuga sylhetensis*	2	1
11	Indian roofed turtle, *Kachuga tecta*	5	11
12	Indian tent turtle, *Kachuga tentoria*	5	11
13	Tricarinate hill turtle, *Melanochelys tricarinata*	3	5
14	Indian black turtle, *Melanochelys trijuga*	7	11
15	Indian eyed turtle, *Morenia petersi*	2	2
16	Keeled box turtle, *Pyxidea mouhotii*	2	1
17	Indian star tortoise, *Geochelone elegans*	4	10
18	Elongated tortoise, *Indotestudo elongata*	3	5
19	Travancore tortoise, *Indotestudo forstenii*	1	3
20	Asian brown tortoise, *Manouria emys*	1	1
21	Indian softshell turtle, *Aspideretes gangeticus*	4	11
22	Indian peacock softshell turtle, *A.hurum*	4	7
23	Leith's softshell turtle, *A.leithii*	2	5
24	Narrow-headed softshell turtle, *Chitra indica*	5	12
25	Asian giant softshell turtle, *Pelochelys cantrorii*	1	2
26	Indian flapshell turtle, *Lissemys punctata*	8	17

Table 34. Habitats of the Indian freshwater turtles and land tortoises

No.	Species	Habitats					
		Reservoir/ marsh	River	Estuary	Grass land	Scrub forest	Hill forest
1	*Batagur baska*			+			
2	*Cuora amboinensis*				+		
3	*Cyclemys dentata*						+
4	*Geoclemys hamiltonii*	+	+		+		
5	*Geomyda silvatica*						+
6	*Hardella thurjii*	+	+				
7	*Kachuga dhongoka*		+				
8	*Kachuga kachuga*		+				
9	*Kachuga smithii*	+	+				
10	*Kachuga sylhetensis*						+
11	*Kachuga tecta*	+	+				
12	*Kachuga tentoria*	+	+				
13	*Melanochelys tricarinata*				+		+
14	*Melanochelys trijuga*	+	+				+
15	*Morenia petersi*	+		+			
16	*Pyxidea mouhotii*						+
17	*Geochelone elegans*					+	
18	*Indotestudo elongata*						+
19	*Indotestudo forstenii*						+
20	*Manouria emys*						+
21	*Aspideretes gangeticus*	+	+				
22	*A.hurum*	+	+				
23	*A.leithii*	+	+				
24	*Chitra indica*		+				
25	*Pelochelys cantrorii*			+			
26	*Lissemys punctata*	+	+	+	+		
	Number of species	11	13	5	4	1	9

FACTORS USED FOR STATUS ASSIGNMENT

i. Distribution

The distribution of a species was considered at global, national and local level. If a species has distribution in India and elsewhere, it has a fair chance for its survival somewhere and hence, a higher rank of survival +2 was given and a species with wide distribution within India (ie. in more then one biogeographic zone) got +1. A species distributed in a small range, restricted to only one biogeographic zone in India was considered as endemic **(Table 33)** and obtained zero point.

ii. Habitat

Species were clumped into two categories; habitat generalist, using more than one habitat and habitat specialist (ie. known to occur in only one type of habitat, **Table 34)**. The habitat generalist got the rank +1 and the specialist -1 (Table 35).

iii. Population

Status assignment of a species in the wild was based on; number of locality records and comparative abundance ie. 'common', 'uncommon' and 'rare'.

(a) Common: Comparative abundance of a species is more than 10% in at least 5 localities preferably in Protected Areas ie. when number of records of all turtle species of a given locality is considered.

(b) Uncommon: Comparative abundance of a given species is more than 10% in at least three localities when number of records of all turtle species of a given locality is considered.

(c) Rare: A species that is insufficiently known or where the species accounts for less than 10% of the turtle populations in all localities. Species with restricted distribution were exempted from the above assumptions and a qualitative approach was followed in these cases (eg. Cochin forest cane turtle and Assam roofed turtle). Due to paucity of data, all (7) Northeast Indian states were considered as one.

Based on the comparative abundance of turtle populations in the wild, three categories were propsed and ranked; common (rank 2), uncommon (rank 1) and rare (rank -1).

iv. Habitat pressure

Factors which affect/alter the habitat that lead to species extinction if unchecked are categorised and ranks given; -1 for presence and 0 for absence (Table 35).

Information obtained from all of the above headings were tabulated using a format (Table 35, 36). Based on the total +ve and -ve survival ranks obtained by a species, four status categories are proposed; Critical, Endangered, Vulnerable and Lower Risk species.

Table 35. Factors used for status assignment of Indian turtles

Factors	Survival points/rank						Survival points	
	-3	-2	-1	0	1	2	Maximum	Minimum
Distribution							3	0
1. India+Outside						+		
2. Wide spread in India					+			
3. Endemic/Restricted				+				
Habitat							1	-1
Generalist					+			
Specialist			+					
Habitat Pressure							0	-1
1. Absent			+					
2. Present				+				
Expoitation							0	-1
1. Absent				+				
2. Present			+					
Population							2	-1
1. Common						+		
2. Uncommon					+			
3. Rare			+					
Total points obtained for(+) and against (-) the Survival of a species.							6	-4

Status of Indian turtles

i. **Critical:** Nine species are proposed for critically endangered status as they got negative scores (Table 36). This includes two softshells (Trionychids), four hardshells (Batagurids) and three tortoises. Immediate conservation action is needed for these species failing which the probability of them becoming extinct in near future is high.

ii. **Endangered:** Three hardshell species secured neither possitive nor negative scores and are proposed for endangered status. They are highly localised and nowhere are common. As in the previous case, these species also need immediate conservation actions.

iii. **Vulnerable:** Five species obtained low positive values (1 to 3) and proposed in the vulnerable status. They are common in a few localities but often associated with habitat pressure and exploitation.

iv. **Lower Risk**: Nine species secured score greater than three. These species may be considered as common and at present they are safe (Table 36).

Table 36. Factors used score given for status categorisation of Indian freshwater turtles and land tortoises

Species	DIstributio n	Habitat	Habitat pressure	Exploitation	Population	Total score
Batagur baska	2	-1	-1	-1	-1	-2
Cuora amboinensis	2	-1	-1	-1	2	1
Cyclemys dentata	2	-1	-1	-1	2	1
Geoclemys hamiltonii	3	1	-1	-1	2	4
Geomyda silvatica	0	-1	-1	0	-1	-3
Hardella thurjii	3	1	-1	-1	2	4
Kachuga dhongoka	3	-1	-2	-1	1	0
Kachuga kachuga	1	-1	-1	-1	-1	-3
Kachuga smithii	3	1	-1	-1	2	4
Kachuga sylhetensis	0	-1	-1	-1	-1	-4
Kachuga tecta	3	1	-1	-1	2	4
Kachuga tentoria	3	1	-1	-1	2	4
Melanochelys tricarinata	3	1	-1	-1	2	4
Melanochelys trijuga	3	1	0	-1	2	5
Morenia petersi	0	-1	0	0	1	0
Pyxidea mouhotii	2	-1	-1	-1	1	0
Geochelone elegans	3	-1	-1	-1	2	2
Indotestudo elongata	3	-1	-1	-1	-1	-1
Indotestudo forstenii	0	-1	-1	-1	2	-1
Manouria emys	2	-1	-1	-1	-1	-2
Aspideretes gangeticus	3	1	-1	-1	2	4
A.hurum	3	1	-1	-1	1	3
A.leithii	1	1	-1	-1	1	1
Chitra indica	3	-1	-1	-1	-1	-1
Pelochelys cantrorii	2	-1	-1	0	-1	-1
Lissemys punctata	3	1	0	-1	2	5

Proposal for the revision of status of turtles and tortoises in the Indian Wildlife Protection Act (1972):

Currently, 16 species of Indian turtles and tortoises are protected by the IWPA 1972. Among them 10 species are in Schudule I and 6 in Schudule IV (Anon 1991). It is proposed that species which secured zero and negative scores (12 species) should be placed in the endangered status listing of the IWPA 1972. Other species (rank 1 to 6, **Table 37**) which have heavy exploitation pressure such as softshells (4 species), larger hardshells (2 species ex. *Hardella thurjii*) and one smaller hardshell (*Kachuga tecta*) and Indian strarred tortoise (*Geochelone elegans*) may be placed in Schudule IV. The rest of the species may be removed from the listing.

Table 37. Indian turtles - proposed legal status with explanation. HT- Heavy trade in this species

Species	IWPA	IWPA Proposed
River Terrapin, *Batagur baska*	I	I
Malayan Box Turtle, *Cuora amboinensis*		
Asian Leaf Turtle, *Cyclemys dentata*		
Spotted Pond Turtle, *Geoclemys hamiltonii*	I	IV (HT)
Cochin Forest Cane Turtle, *Geoemyda silvatica*	I	I
Crowned River Turtle, *Hardella thurjii*		IV (HT)
Three-striped Roof Turtle, *Kachuga dhongoka*		I
Red-crowned Roof Turtle, *Kachuga kachuga*	I	I
Brown Roofed Turtle, *Kachuga smithii*		
Assam Roofed Turtle, *Kachuga sylhetensis*		I
Indian Roofed Turtle, *Kachuga tecta*	I	
Indian Tent Turtle, *Kachuga tentoria*		
Tricarinate Hill Turtle, *Melanochelys tricarinata*	I	
Indian Pond Turtle, *Melanochelys trijuga*		
Indian Eyed Turtle, *Morenia petersi*		I
Keeled Box Turtle, *Pyxidea Mouhotii*		I
Indian Starred Tortoise, *Geochelone elegans*	IV	IV (HT)
Elongated Tortoise, *Indotestudo elongata*	IV	I
Travancore Tortoise, *Indotestudo forstenii*	IV	I
Asian Brown Tortoise, *Manouria emys*	IV	I
Indian Flapshell Turtle, *Lissemys punctata*	I	IV (HT)
Indian Softshell Turtle, *Aspideretes gangeticus*	I	IV (HT)
Indian Peacock Softshell turtle, *A. hurum*	I	IV (HT)
Leith's Softshell Turtle, *A. leithii*	IV	IV (HT)
Narrowheaded Softshell Turtle, *Chitra indica*	IV	I
Asian Giant Softshell Turtle, *Pelochelys cantorii*	I	I

RECOMMENDATIONS

Suggestions for turtle conservation in India are given in previous sections especially in Chapter III and VI. However, some important points are discussed here.

1. FURTHER SURVEY

Further status surveys are urgently needed for species such as *Kachuga kachuga, K. dhongoka, K.sylhetensis, Manouria emys* and *Chitra indica*. These species are habitat specialists prefering specific habitats. *K. kachuga, K. dhongoka* and *C. indica* inhabit only rivers and also they are known from only a few localities in recent years. *K. sylhetensis* and *M. emys* have restricted distribution in Northeast India and their status and distribution is poorly known. *Morenia petersi* has a peculier distribution; distributed only in the northern tributaries and lower reaches of Ganges system. Moll's survey in 1983 reported that this species was common in the vicinity of Gandak river, Northern Bihar. However, the present survey did not obtain evidence for its presence there. As this species has a small range and its biology is not known, a survey is required.

Further turtle surveys are recommended for South-northeastern India (Nagaland, Manipur, Mizoram and Tripura), Western Ghats and Northwestern states such as Haryana and Himachal Pradesh. The turtle survey in South- Northeastern India is required as this area has not been explored for turtles in over 50 years. A Western Ghats turtle survey is needed to find out the extant of distribution of endemic turtles there. This is beacuse the present survey located new distribution areas for endemic species; *Geoemyda silvatica* and *Indotestudo forstenii* far away from their known range. Virtually nothing is known about the turtle fauna of Himachal Pradesh and Haryana and hence, a survey is suggested.

2. PROTECTED AREAS

The following localities are proposed for Protected Area status; 1. Mupa-Lanteng RF, North Cachar Hills, Assam (Tortoise) 2. Kothaiyar RF, Kanniyakumari, Tamil; Nadu (Endemic turtles) 3. Balassor, Orissa (estuarine species); 4. Mahanadi river near Cuttack, Orissa (riverine softshell turtles) 5. Bhigwan (Dhond), Maharastra (river and marshland species) 6. Madanapalle RF, Chitoor, Andhra Pradesh (*Geochelone elegans*).

Apart from *Manouria emys*, the Mupa-Lanteng RF harbours many little known species such as *Cyclemys dentata*, *Pyxidea mouhotii*, *Melanochelys tricarinata* and *Aspideretes hurum* and hence, the sanctuary status will provide more protection. Kothaiyar RF, Kanniyakumari, Tamil; Nadu has high densities of *Indotestudo forstenii*. *Geoemyda silvatica* may also present there. Proper protection by elevating it to a sanctuary status will be beneficial for these endangered species. Dr. Moll's survey in 1983 recorded *Pelochelys cantorii* on the Balassore coast. It is one of the few areas where this species occurs in India. Hence, protecion is required to save this species within Indian limits. Bhigwan (Dhond), Maharastra and

Mahanadi, Cuttack, Orissa may be among the few known localities where rare and endangered *C. indica* is common. Also, these localities have considerable populations of other softshells. The tropical thorn forest of Madanapalle RF, Chitoor, Andhra Pradesh have high densities of *Geochelone elegans*. Organised trade exists on this species in the above mentioned area. The elevation this area into a Sanctuary may perhaps provide to this tortoise as well as many scrub forest dwelling life forms.

3. ECOLOGICAL STUDIES

Three ecological studies on turtles are suggested:

1. Endemic turtles: Very little is known about the endemic turtles namely, Cochin forest cane turtle (*Geoemyda silvatica*) and Travacore tortoise (*Indotestudo forstenii*). They are rare and endemic to the Western Ghats of South India. A study on the biology of these species would give better understanding in the conservation and management of turtles in India.

2. Species prefering forest floor: Many little known species such as the Asian brown tortoise (*Manouria emys*), Asian leaf turtle (*Cyclemys dentata*), Keeled box turtle (*Pyxidea mouhotii*), Tricarinate hill turtle (*Melanochelys tricarinata*) thrive in the hill forests of Northeastern India. The biology of these species is not known. Also, the forest in these area is under pressure from slash and burn agricultural practices. The impact of agricultural practices on turtles may be studied. The Mupa-Lanteng RF would be a suitable locality for such a study.

3. Riverine turtles: Northern part of the Ganges system, especially Bihar and Uttar Pradesh which have a number of riverine species. Similar to the studies done in the Chambal river at Morena, Madhya Pradesh, a community ecology of turtles in this area will provide much needed information for the conservation and management of riverine species. Valmik TR and Berhari WLS, Bihar may be an ideal sites for such a study.

4. EXPLOITATION CONTROL

Compared to the turtle trade situation in India documented by Moll in 1983, the present level of trade appears to be in low key. Periodic monitoring of markets is suggested. Illegal trade on *Geochelone elegans* should be controlled as this species is being summgled out of the countries for pet trade. The internal commercial trade in turtles as food is mainly of the commonest and abundant species, *Lissemys punctata*. While the Indian Wildlife (Protection) Act has several species in Schedule I, that are very common and have a wide distribution, endemic species having small ranges and population size are not on the Schedule I. A subsistence level of trade and utilization of all turtles and tortoises is common in Northeastern, Eastern India and Southern India. The inclusion of turtles in Schedules of the Wildlife Protection Act is not known to such users or even to official agencies such as the Indian Railways. The recommendations emerging out of the present study may necessitate some policy changes, direct actions and a fair degree of coordination between several agencies to curb illegal trade and rational utilization of turtles and tortoises in India.

The freshwater turtle trade is dependent on the Indian Railway and road transport. Freshwater turtles are concealed along with frozen fish and/or live fish and booked through the Indian Railways or through road transport. The final destination of turtles has been either in Howrah or Bandel railway station or other wholesalers and retailers receiving stock from road transporters. Railway stations along the Ganges river in U.P. and Bihar and stations in Orissa and Andhra Pradesh book large quantities of fish for Calcutta market. The Environment Ministry should alert the Indian Railway authorities particularly the Northern, Eastern and Southeastern railway authorities of this clandestine activity. The railway security force may also be alerted. The association of road transporters should be informed of the consequences of such illegal transport of turtles. The Railways and roadways must be made aware of the illegal nature of such cargo.

5. **CAPTIVE BREEDING**

Captive breeding of riverine hardshells (*Kachuga kachuga*, and *K.dhongoka*) and softshell (*Chitra indica*), estuarine species *Batagur baska* and *Pelochelys cantorii* and *Manouria emys* is urgently needed. All these species are rare and may become locally extinct in near future.

Riverine species such as *K. kachuga*, *K.dhongoka*, and *C. indica* may be bred at suitable locations in U.P and Bihar for reintroduction in Ganges. Available facilities at Deori Gharial Breeding Centre, Madhya Pradesh and Kukrail Turtle Breeding Centre, Lucknow in Uttar Pradesh may be utilised for this purpose.

Estuarine species namely *B. baska* and *P. cantorii* could be bred in Sunderbans TR for reintroduction as these species have become very rare in the wild. Turtle Breeding facilities at Sajanakhally and Pakiralaya of the Sunderban TR may be developed for this purpose.

Manouria emys is heavily utilised by the inhabitants of this area. This is the largest tortoise species seen in Asia. A captive breeding programme may be initiated at Mupa-Lantang RF for reintroduction in North Cachar Hills and nearby forests.

6. **STATUS ASSIGNMENT**

The status listing of turtle species in the Indian Wildlife Protection Act (1972) may suitably be amended based on the findings of the present work (see Chapter VII, **Table 37**).

7. **REFERENCE COLLECTION**

Collections of turtles in the Indian Museums and Indian Zoos should be strengthened for further taxonomical studies and public awareness.

LITERATURE CITED

Anon 1991. The Wildlife Protection Act 1972 (as amended upto 1991). Natraj Publishers, Dehra Dun.

Auffenberg, W. 1964. Notes on the courtship of the land tortoise *Geochelone travancorica* (Boulenger). *J. Bombay nat. Hist. Soc.* 61 (2): 247-253.

Auffenberg, W. 1981. Behaviour of *Lissemys punctata* in a drying lake in Rajasthan, India. *J. Bombay nat. Hist. Soc.* 78 (3): 487-493.

Bhadauria, R.S., A. Pai and D. Basu 1990. Habitat, nesting and reproductive adaptations in Narrow-headed softshell turtle *Chitra indica* (Grey), (Reptilia: Chelonia). *J. Bombay nat. Hist. Soc.* 87 (3):364-397.

Bhupathy, S. 1990. Observations on the food of Ganges Soft- shell Turtle *Trionyx gangeticus* in Keoladeo National Park, Bharatpur. *J. Bombay nat. Hist. Soc.* 87(3):460-461.

Bhupathy, S. 1994: The distribution of Asian Brown Tortoise *Manouria emys* in India and the taxonomic status of subspecies. *J. Bombay nat. Hist. Soc.* 91 (1): 147-149.

Bhupathy, S. 1997. Conservation of the endangered River terrapin *Batagur baska* in the Sunderban of West Bengal, India. *J. Bombay nat. Hist. Soc.* 94 (1): 27-35.

Bhupathy, S. and C.R.Ajith Kumar 1988. On the identity and occurrence of the Peacock Soft shell (*Trionyx hurum*) in Rajasthan. *J.Bombay nat. Hist. Soc.* 85 (3): 624.

Bhupathy, S. and B.C.Choudhury 1994. A note on the reproductive biology of the Spotted pond turtle, *Geoclemys hamiltonii. J. Bombay nat. Hist. Soc.* 91(1) : 146-147.

Bhupathy, S. and B.C.Choudhury 1995. Status, distribution and conservation of the Travancore tortoise, Indotestudo forstenii in Western Ghats. *J. Bombay nat. Hist. Soc.* 92(1) : 16-21.

Bhupathy, S. and V.S.Vijayan 1989. Predation on the Indian Flap-shell Turtle (*Lissemys punctata*) in Keoladeo National Park, Bharatpur, Rajasthan. *Proc. Nat. Symp. Anim. Behav.*, In: Behaviour (B.H.Patel, ed.) Sir P.P. Institute of Science, Bhavnagar :27-33.

Bhupathy, S. and V.S.Vijayan 1991. Freshwater turtle fauna of eastern Rajasthan. *J.Bombay nat. Hist. Soc.*, 88 (1): 118-122.

Bhupathy, S. and V.S.Vijayan 1993. Food of Indian Flapshell Turtle (*Lissemys punctata*) in Keoladeo National Park, Bharatpur. *Hamadryad* 18:13-16.

Bhupathy, S. and V. S.Vijayan 1994. Aestivation of turtles in Keoladeo National Park with special reference to *Lissemys punctata (*Reptilia: Trionychidae). *J. Bombay nat. Hist. Soc.* 91(3):398-402.

Choudhury, B.C. and S. Bhupathy 1992. An inventory of freshwater turtles and land tortoises in captivity in Indian Zoos. *Zoos' Print* VII (12): 4-10.

Choudhury, B.C. and S.Bhupathy 1993. Turtle trade in India. A study of tortoises and freshwater turtles. WWF-India. (Prepared by TRAFFIC-India), New Delhi.

Daniel, J.C. 1983. The book of Indian reptiles. *Bombay Natural History Society.141 pp.*

Das, I. 1985. Indian turtles: A field guide. World Wildlife Fund-India (Eastern Region), Calcutta. 119 p.

Das, I. 1988. New locality record for the Indian peacock softtshell turtle *Trionyx hurum. J.Bombay nat. Hist. Soc.* 84 (3):691-692.

Das, I. 1990. Distributional records for chelonians from Northeastern India. *J. Bombay nat. Hist. Soc.* 87 (1) : 91-97.

Das, I. 1990a. The export of freshwater turtles from Bangladesh. *Oryx 24(3): 163-166.*

Das, I. 1991a. Turtle conservation programme at Madras Crocodile Bank. *Tiger Paper* 18 (1):16-18.

Das, I. 1991b. Colour guide to the turtles and tortoises of the Indian subcontinent. R & A Publishing Limited.

Das, I. 1995. Turtles and tortoises of India. Oxford University Press, Bombay.

Das, I. 1997. *Kachuga sylhetensis* recorded from northern Bengal, with notes on turtles of Gorumara National Park, eastern India.. *Chelonian Conserv. & Biol.* 2(4): 616-617.

Duda, P.L. and V.K. Gupta 1982. Trans abdominal migration of ova in some freshwater turtle. *Proc. Indian Acad. Sci. (Anim. Sci.)* 91(2): 189-197.

Duda, P.L. and D.N. Sahi 1977. An updated checklist of herpetiiles of Jammu and Kashmir. *Univ. Rev.* 6 (10): 1-7.

Frazier, J. 1992a. Management of tropical chelonians : Dream or nightmare ? **Tropical Ecosystem : Ecology and Management.** eds. K.P. Singh and J.S. Singh, Wiley Eastern Limited : 125-135.

Frazier, J. 1992b. The land tortoises in Nepal: A review. J.Bombay nat. Hist. *Soc. 89 (1):45-54.*

Frazier, J. G. and I. Das 1994. Some notable records of Testudines from the Indian and Burmese subregions. *Hamadryad* 19:47-66.

Fugler, C.M. 1984. The commercially exploited Chelonia of Bangladesh : Taxonomy, ecology, reproductive biology, and ontogeny. *Bangladesh Fish. Inf. Bull.* 2(1):i-v, 1-52.

Gosh, A. and N.R. Mandal 1990. Studies on the nesting and artificial hatching of the endangered River terrapin *Batagur baska* (Grey) in the Sunderbans Tiger Reserve, West Bengal. *J. Bombay nat. Hist. Soc. Hist.* 87 (1):50-52.

Iverson, J.B. 1986. A checklist with distribution maps of the turtles of the world. Privately Printed, Paust printing, Richmond, 283 pp.

Javid, S. and F. Hanfi 1995. Freshwater turtles of Dudwa National Park and their conservation. *Hamadryad* 20:21-26.

Jayson, E. A. 1993. Starred tortoise *Geochelone elegans* (Schoepff) in Chinnar Wildlife Sanctuary, Kerala. *J. Bombay nat. Hist. Soc.* 90 (1):112.

Kalaiarasan, V., R. Kanakasabai and B. Rathinasabapathy 1992. Record of the riverine turtle *Trionyx leithi* from Thanjavur district, Tamil Nadu. *J. Bombay nat. Hist. Soc.*89(2):258-259.

Khan, M.A.R. 1982. Chelonians of Bangladesh and their conservation. *J. Bombay nat. Hist. Soc.* 79:110-116.

Mace, G.M. and R. Lande 1991. Assessing extinction threats: Toward a reevaluation of IUCN threatened species categories. *Conservation Biology* 5(2):148-157.

Mace, G. and S. Stuar 1994. Draft IUCN Red List Categories, Version 2.2. *Species* ..... :13-24.

Meylan, P.A. 1987. The phylogeny of softshelled turtles (Family: Trionychidae) *Bull. American Mus. nat. Hist.* 186 (1):1-101.

Moll, E.O 1984. Freshwater turtles in India: their status, conservation and management. *Hamadryad* 9(3): 9-17.

Moll, E.O. 1986. Survey of the Freshwater Turtles of India Part I : The Genus *Kachuga. J. Bombay nat. Hist. Soc.* 83 (2) : 538-552.

Moll, E.O. 1987. Survey of the Freshwater Turtles of India Part II : The Genus *Kachuga. J. Bombay nat. Hist. Soc.* 84 (1) : 7-25.

Moll, E.O 1989. Indotestudo forstenii Travancore tortoise. In. The Conservation biology of tortoises. pp. 118. I.R. Swingland & M.W.Klemens (eds.) *Occ. Paper IUCN/SSC No.*5.

Moll, E.O. 1991. India's freshwater turtle resource with recommendations for management. In Conservation in developing countries : Problems and prospects. J.C. Daniel and J.S. Serrao (Eds.). Bombay Natural History Society and Oxford University Press, Bombay. pp : 501-515.

Moll, E.O. and J. Vijaya 1986. Distributional records for some Indian turtles. J. Bombay Nat. Hist. Soc. 83 (1) : 57-62.

Moll, E.O., B. Groombridge and J. Vijaya 1986. Rediscription of the Cane turtle with notes on its natural history and classification. *J. Bombay Nat. Hist. Soc. 83 (Supplement)* : 112-126.

Moll, E.O., and J. Vijaya 1986. Distribution records for some Indian turtles. *J. Bombay Nat. Hist. Soc. 83 (1)*: 57-62.

Rabinowitz, D.S., S. Cairns and T. Dillon 1986. Seven forms of rarity and their frequency in the flora of the British Isles. pp. 182-204. In. M.E. Soule (ed). Conservation biology - the science of scarcity and diversity. Sinauer Associates, Sunderland, Massachusetts.

Raghuwanshi, A. 1975. Hypothalamo-hypophysial complex and reproductive endocrinology of turtle *Lissemys punctata granosa* (Schoepff). Ph. D. Dissertation, Vikram University, Ujjain.

Rao, R.J. 1985. Sexual cycle of the male freshwater turtle *Trionyx gangetics* (Cuvier). *Herpetologica* 41(4): 433-437.

Rao, R.J. 1986. Notes on the Sexual Cycle of female *Trionyx gangetics* in central India. *J.Herpetol.* 20(3): 455-457.

Rao, R.J. 1991. Ecological relationships among freshwater turtles in the Chambal Sanctuary. Study report. Wildlife Institute of India, Dehra Dun.

Rao, R.J. and L.A.K. Singh 1987. Notes on comparative body sizes, reproductive effort and areas of management priorities for three species of *Kachuga* (Reptilia: Chelonia) in the National Chambal Sanctuary. *J. Bombay nat. Hist. Soc.* 79(2): 429-430.

Rodgers, W.A. and H.S. Panwar1988. Planning Wildlife Protected Area network. Vol I. Wildlife Institute of India, Dehra Dun.

Smith, M.A. 1931. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. I. Loricata and Testudines. Taylor and Francis, London.

Smith, M.A. 1933-1945. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II & III. Loricata and Testudines. Taylor and Francis, London.

Stubbs, D. 1991. Tortoises and Freshwater turtles: an action plan for their conservation. IUCN, Gland.

Tikader, B.K. and R.C. Sharma 1985. Handbook: Indian Testudines. Zoological Survey of India, Calcutta. 156 pp.

Varghese, G. and G.T. Tonapi 1986. Observation on the identity of some Indian freshwater turtles and their feeding habits. *Biol. Conserv. 37:87-92.*

Vyas, R. and B.H. Patel 1990. A survey of freshwater turtles of Gujarat. *J.Bombay nat. Hist. Soc.* 87(1) : 152-155.

Webb, R.G. 1980. The identity of *Testudo punctata* Lacepede, 1788 (Testudines, Trionuchidae). *Bull. Mus. Nat. Hist. nat., Paris* 2(2):547-557.

Webb, R.G. 1995. Rediscription and neotype designation of *Pelochelys bibroni* from southern New Guinea (Testudines: Trionychidae). *Chelonian Conserv. & Biol.* 1: 301-310.

Yadav, M.R. 1983. Breeding biology of the Indian tropical pond turtle, *Lissemys punctata granosa* (Schoepff). *Ph.D. Dissertation*, Banaras Hindu University, Varanasi.

Appendix I. Indian turtles: present (1993) conservation and legal status

Species	IWPA	RDB	CITES
River Terrapin, *Batagur baska*	I	E	I
Malayan Box Turtle, *Cuora amboinensis*			
Asian Leaf Turtle, *Cyclemys dentata*			
Spotted Pond Turtle, *Geoclemys hamiltonii*	I	I	I
Cochin Forest Cane Turtle, *Geoemyda silvatica*	I	V	
Crowned River Turtle, *Hardella thurjii*			
Three-striped Roof Turtle, *Kachuga dhongoka*			
Red-crowned Roof Turtle, *Kachuga kachuga*		I	
Brown Roofed Turtle, *Kachuga smithii*			
Assam Roofed Turtle, *Kachuga sylhetensis*		K	
Indian Roofed Turtle, *Kachuga tecta*	I	I	
Indian Tent Turtle, *Kachuga tentoria*			
Tricarinate Hill Turtle, *Melanochelys tricarinata*	I	I	I
Indian Pond Turtle, *Melanochelys trijuga*			
Indian Eyed Turtle, *Morenia petersi*			
Keeled Box Turtle, *Pyxidea Mouhotii*			
Indian Starred Tortoise, *Geochelone elegans*	IV		II
Elongated Tortoise, *Indotestudo elongata*	IV	K	II
Travancore Tortoise, *Indotestudo forstenii*	IV	R	II
Asian Brown Tortoise, *Manouria emys*	IV	K	II
Indian Flapshell Turtle, *Lissemys punctata*	I		I
Indian Softshell Turtle, *Aspideretes gangeticus*	I		I
Indian Peacock Softshell turtle, *A. hurum*	I		I
Leith's Softshell Turtle, *A. leithii*	IV		
Narrowheaded Softshell Turtle, *Chitra indica*	IV		
Asian Giant Softshell Turtle, *Pelochelys cantorii*	I		

Note: **IWPA**-Indian Wildlife (Protection) Act 1972, **RDB**-Red Data Book of IUCN Amphibia & Reptilia (updated 1988). Red Data Book. IUCN RDB Categories of Threat are as folloWLS : E: Endangered; V: Vulnerabla; R: Rare; I: Indeterminate; K: Insufficiently Known, **CITES**-Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Appendix II. Publications

1) **S.Bhupathy, B.C.Choudhury and E.O. Moll (1992)** : Conservation and Management of freshwater turtles and Land Tortoises of India. Turtle and Tortoise Conservation Project. Technical Report May 1991 - July 1992. Wildlife Institute of India, Dehra Dun.

2) **B.C.Choudhury and S.Bhupathy (1992)** : An inventory of freshwater turtles and land tortoises in captivity in Indian Zoos : Results of a survey. *Zoos' Print* VII (12) : 4-10.

3) **S.Bhupathy, B.C.Choudhury and E.O. Moll (1993)** : Conservation and Management of freshwater turtles and Land Tortoises of India. Turtle and Tortoise Conservation Project. Technical Report No 2. May 1992 - July 1993. Wildlife Institute of India, dehra Dun (draft submitted August 1993)

4) **B.C.Choudhury and S.Bhupathy (1993)** : Turtle Trade in India. WWF-TRAFFIC INDIA, New Delhi.

5) **B.C.Choudhury & S.Bhupathy (1993)**: An Action Plan for Conservation & Management of Freshwater Turtles and Land Tortoises in India. Paper presented at the International conference on Conservation, Restoration and Management of Tortoises and Turtles. July 1993, New York, USA (abstract).

6) **S.Bhupathy (1994)**: The distribution of Asian Brown Tortoise *Manouris emys* in India and the taxonomix status of subspecies. *J.Bombay nat.Hist.Soc.* 91: 147-149.

7) **S.Bhupathy and B.C.Choudhury (1994)** : A note on the reproductive biology of the Spotted pond turtle, *Geoclemys hamiltonii. J.Bombay nat. Hist.Soc.*91: 146-147.

8) **S.Bhupathy, C.S.Silori and S.F. Wesley Sunderraj (1994)**: Additional locality records for two Indian tortoise species. *J. Bombay nat.Hist.Soc.*91: 149-150.

9) **S.Bhupathy and B.C.Choudhury (1995)** : Status, distribution and conservation of the Travancore Tortoise, *Indotestudo forstenii* in Western Ghats. *J.Bombay nat. Hist. Soc.* 92(1):16-21.

Appendix III. Turtle/tortoise specimens examined at National Museum, Calcutta and at the museum of Bombay Natural History Society.

No.	Species	ZSI Museum	BNHS Museum
1	Spotted pond turtle		
	Geoclemys hamiltonii	5	1
2	Assam roofed turtle		
	Kachuga sylhetensis	3	-
3	Tricarinate hill turtle		
	Melanochelys tricarinata	6	2
4	Indian eyed turtle		
	Morenia petersi	3	1
5	Keeled box turtle		
	Pyxidea mouhotii	3	-
6	Elongated tortoise		
	Indotestudo elongata	6	-
7	Indian Peacock softshell turtle		
	Aspideretes hurum	14	2
8	Narrow headed softshell turtle		
	Chitra indica	2	2
9	Asian giant softshell turtle		
	Pelochelys cantorii	1	-
10	Travancore tortoise		
	Indotestudo forstenii	-	6

Appendix IV. Area surveyed and their location in biogeographic zone

No.	Biogeographic zone	Survey locality	State	Area (in Sq km)
1	I. Himalayas	Buxa NP/WLS	West Bengal	369.10
2		Namdapha NP	Arunachal Pradesh	1985.00
3		D'Ering WLS	Arunachal Pradesh	190.00
4		Itanagar WLS	Arunachal Pradesh	140.00
5		Mehao WLS	Arunachal Pradesh	282.00
6		Pakhui WLS	Arunachal Pradesh	863.00
7	II. Indian Desert	Wild Ass WLS	Gujarat	4954.00
8		Bhuj (Kachchh)	Gujarat	-
9	III.Semiarid	Harike WLS	Punjab	41.00
10		Simbalbara WLS	Himachal Pradesh	19.00
11		Gir WLS/NP	Gujarat	1412.00
12		Tapi River	Gujarat	-
13		Bharuch	Gujarat	-
14		Nat. Chambal S.	Madhya Pradesh	320.00
			Uttar Pradesh	635.00
			Rajasthan	280.00
15		Keoladeo NP	Rajasthan	29.00
16	IV. Western Ghats	Sanjay Gandhi NP	Maharashtra	87.00
17		Bhimashankar WLS	Maharastra	131
18		Sharavathi WLS	Karnataka	431.00
19		Neria estate	Karnataka	-
20		Indira Gandhi NP/WLS	Tamil Nadu	859.00
21		Mudumalai NP	Tamil Nadu	321.00
22		Kalakad WLS	Tamil Nadu	224.00
23		Mundanthurai WLS	Tamil Nadu	567.00
24		Kothaiyar RF	Tamil Nadu	60.00
25		Neyyar WLS	Kerala	128.00
26		Parambikulam WLS	Kerala	285.00
27		Peechi-Vazhani WLS	Kerala	125.00
28		Peppara WLS	Kerala	53.00
29	V. Deccan Peninsula	Dalma WLS	Bihar	193.20
30		Lakhari Valley WLS	Orissa	186.00
31		Narmada river	Madhya Pradesh	-
32		Bhigwan, Pune	Maharastra	-
33		Mula-Mutha, Pune	Maharastra	-
34		Kolleru WLS	Andhra Pradesh	673.00
35		Lanjamadagu Siwaram WLS	Andhra Pradesh	30.00
36		Manjira WLS	Andhra Pradesh	20.00
37		Nagarjunasagar-Srisailam TR	Andhra Pradesh	3000.00
38		Pakhal WLS	Andhra Pradesh	878.00
39		Papikonda WLS	Andhra Pradesh	591.00
40		Pocharam WLS	Andhra Pradesh	130.00
41		Sri-Venkateswara NP/WLS	Andhra Pradesh	507.00
42		Rollapadu WLS & Vicinity	Andhra Pradesh	4.00
43		Mookambika WLS	Karnataka	247.00
44		Tungabadra, Shimoga	Karnataka	-
45	VI. Gangetic plain	Corbett NP	Uttar Pradesh	521.00
46		Rajaji NP	Uttar Pradesh	274.00

47		Narora	Uttar Pradesh	-
48		Valmiki NP/WLS	Bihar	797.00
49		Saranda RF	Bihar	-
50		Ganges, Begusarai	Bihar	-
51		Kabar jhell	Bihar	
52		Gorumara WLS	West Bengal	8.52
53		Jaldapara WLS	West Bengal	216.00
54		Mahananda WLS	West Bengal	126.00
55		Mahanadi, Cuttack	Orissa	-
56	VII. Coast	Sunderban NP	West Bengal	1330.10
57		Bhiatarkanika NP	Orissa	367.00
58		Coringa WLS	Andhra Pradesh	236.00
59	VIII.Northeast India	Kaziranga NP	Assam	430.00
60		Mupa-Lantang RF, NC Hills, Assam	Assam	60.00 (app.)
61		Nameri WLS	Assam	130.00
62		Orang WLS	Assam	72.00

Appendix V. Resource persons utilized for various survey sectors

Market survey, Calcutta (Monsoon)	:	Ms. Kaberi Kar Gupta
I. Western Ghats		
Neria forest	:	Mr.Nitin D. Rai, Mr.B.K.Sharath
Sharavati and Mookambika WLS	:	Mr.Anand Jesupriya
Parambikulum	:	Mr.K.S.Appukuttan
Mudumalai	:	Mr.Chandrasekar Silori, Mr.R. Arumugam
II. Sunderbans	:	Mr.Rathin Banerjee
III. Northeastern India		
North Cachar hills	:	Mr. Moloy Bora, Chhaya Singh Daulagupu (RO)
Kaziranga National Park	:	Mr.Parag Moley & Mr.Mithi
Orang & Nameri WLS	:	Mr. Manideep Raj
Ittanagar	:	Mr. Pratap Singh
Paighat	:	Dr.K.K. Bhatacharji, Mr. Oni Dai
Roing	:	Mr.A.K. Sen, Mr. Madhusoodan Katti,Ms. Kaberi Kar Gupta
Namdapha	:	Mr.Bhatt,Research Officer, Mr. A.K. Sen
IV. Western India:		
a) Narmada River survey	:	Mr. Parikshit Goutam, Mr. Ragu Ram Tata, Mr. S.A. Hussain, Dr. Dixit, Dr. Rajprohit, Mr. Raju Vyas, Mr. Karmaveer Bhatt, Mr. Thiruvangadam
V. Andhra Pradesh survey	:	Mr.G.Narasimham
VI.Orissa survey	:	Mr.Bibash Pandav
VII. Northern West Bengal survey	:	Mr.Shankar Mandal
VIII. Punjab Survey	:	Ms.Kamaljeet Kaur