Cobra

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MADRAS SNAKE PARK TRUST

Quarterly Newsletter of the Madras Snake Park Trust

Cover

Chittul or Annulated Sea Snake (*Hydrophis cyanocinctus*)

One of the commoner of the twenty species of sea snakes found along the coast of India. All sea snakes are highly venomous, but rarely bite humans.

Photo : **R.J. Ranjit Daniels.**

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CONTENTS

Cobra invites articles and short notes on reptiles and amphibians, their ecology, biology, natural history, conservation or other aspects. These may be of scientific or popular interest. Black and white photographs are also welcome.

Please send your contributions to the Editor, **Cobra**, Madras Snake Park Trust, Rajbhavan Post, Chennai 600 022.

A noiseless patient spider,
I mark'd where on a little promontory it stood isolated,
Mark'd how to explore the vacant vast surrounding,
It launch'd forth filament, filament, filament, out of itself,
Ever unreeling them, ever tirelessly speeding them.

And you, O my soul, where you stand,
Surrounded, detached, in measureless oceans of space,
Ceaselessly musing, venturing, throwing, seeking
the spheres to connect them,
Till the bridge you will need be form'd, till the ductile anchor hold,
Til the gossamer thread you fling catch somewhere, O my soul.

- Walt Whitman.

Ecological notes on the Herpetofauna of Ladakh Region in J&K State (India)

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Reports dealing exclusively with the herpetiles of the Jammu & Kashmir State in general and Ladakh region in particular are sporadic and scant except for Boulenger (1890), Das (1967), Dubois (1978), Duda & Koul (1977), Duda, Verma & Sahi (1993), Gunther (1864), Sahi & Duda (1983 and 1985), Smith (1935 and 1943), Verma & Sahi (1995a; 1995b; 1995c; 1996). In the present communication an attempt has been made to enlist all the amphibians and reptiles tolerating the hostile climatic conditions of the Trans-Himalayan region of Ladakh in Kashmir Province of J&K State, along with some ecological notes.

Ladakh is the northernmost area of J&K State (India) situated at an altitude between 2,900m - 5,900m; lying between 32° - 36° N and 76° - 79° E (Figure 1). Ladakh is one of the loftiest inhabited regions of the world sandwiched between towering Karakoram and Kvenlum ranges in the north and the Himalayas in the south. This region is uniformly cold and dry during most part of the year with temperature regime of -40° C in winter and 37° C in summer, with almost no annual precipitation. It is a cold desert having sparse vegetation.

The present report records 14 species of herpetiles (3 amphibians; 8 lizards and 3 snakes) within the Indian boundary of Ladakh.

Amphibians

Family : Bufonidae

1. *Bufo viridis* (European Green Toad)
   Bufo viridis Laurenti (1768) *Syn. Rept.* p. 27 (Type locality : Vienna).

Materials examined : 8 ; 3 males and 5 females from Dras, Kargil and Khalsi in Ladakh region.

European green toad is a high altitude species and is reported to occur in the Middle, Greater and Trans - Himalayan ranges in J&K State. In Ladakh region the specimens were collected in sparse vegetation and near the streams at an altitude ranging from 2,680m - 3,250m. Breeding starts in May. It mainly feeds on insects.

2. *Bufo latastii* Boulenger
   Bufo latastii; Boulenger : *Cat. Batr. Sal.* p. 204 (Type locality : Ladakh).

Materials examined : 5 (sex not determined).

The Ladakh toad has restricted distribution in Trans-Himalayan ranges of Ladakh. It is endemic and resembles *Bufo viridis* closely. Specimens were collected near springs and fish rearing ponds at Shey in Ladakh.

Family : Pelobatidae

3. *Scutiger occidentalis* Dubois
   Scutiger occidentalis Dubois 1978. *Senckenbergina. Biol.* 59 (3-4) p. 163. (Type locality : Ladakh).

Materials examined : 10 ; 4 males and 6 females from Kargil and Khalsi in Ladakh region.

Scutiger occidentalis is a high mountain amphibian. It has a restricted range of distribution and was first reported by Dubois in 1978. A stenothermal species, it occurs in cold, semi-arid area in Ladakh (Kargil, Khalsi). Specimens were collected during the months of June and July from under stones in and near streams. Breeding season - June to July. Mass of 105 eggs, enclosed in a jelly like substance, was found attached to a stone which was partially submerged in a slow running stream in Kargil.

Reptiles ; Lizards

Family : Agamidae

1. *Phrynocephalus theobaldi* (Kashmir Toad Agama)
   Phrynocephalus theobaldi Blyth (1863) *J. Asiat.Soc. Bengal* XXXII, p. 90 (Type locality : Lake Tsho-Marari, Rupshu province, Tibet : type lost).

Materials examined : 12 ; 7 males and 5 females from Bodhkharbu and Leh in Ladakh region.

The specimens were collected on the slopes of Kashmir - Ladakh National Highway. The tract is almost devoid of any plant cover. It is a very active lizard, which when cornered assumes a threatning posture by raising its body off the ground and opening its mouth widely. At the sight of any danger, the lizard burrows itself quickly under the ground and burrowing may be as deep as 25 cm. Lizard feeds on high altitude beetles, ants, grasshoppers and spiders. This species co-exists with *Crytodactylus stoliczkai, Crytodactylus lawderanus, Agama himalayana* and *Scincella ladacense*. Two live lizards, captured on 15th June 1993 fron Leh (3,522m, m.s.l) were brought to the department of Biosciences, University of Jammu, Jammu (275m, m.s.l.). On 20 th June, 1993, one of the lizards laid 2 eggs, one of which hatched on 29th July, 1993 i.e. after 39 days of its laying, whereas the other remained unhatched.

2. *Phrynocephalus reticulatus* (Ladakh Toad Agama)
   Phrynocephalus reticulatus Eichwald (1831)Zool. Spec., p. 183, (Type Locality: Leh)

Materials examined : 2 ; 1 male and 1 female from Leh.

Habits similar to *P. theobaldi* but an uncommon species. About *Phrynocephalus reticulatus,* Smith (1935, p. 232) recorded " The species is included in the fauna of Indian empire on the strength of a single specimen in the British museum collected by Schlagintweit Brothers and said to have come from Ladakh". The collection of 2 specimens of *Phrynocephalus reticulatus* from Ladakh confirms its occurence within Indian limits (Sahi & Duda 1983).

3. *Agama himalayana himalayana* (Himalayan Rock Agama).
   Stellio himalayans Steindachner (1869) p. 22, (Type locality : Ladakh).

Materials examined : 15 ; 5 males and 10 females from Dras, Kargil, Bodh Kharbu and Leh in Ladakh region.

It is a montane species found restricted to the Trans-Himalayan ranges in Ladakh region of Kashmir province. It is found inhabiting the crevices of rocks and under loose-stones. It burrows itself in loose soil at any sight of danger. It is often seen coexisting with *Cyrtodactylus stoliczkai* and *Cyrtodactylus lawderanus*. It is insectivorous in habit.

Family : Gekkonidae

4. *Cyrtodactylus montium salsorum* (Salt Range Rock Gecko)
   Gymnodactylus montium salsorum Annandale (1913). *Rec. Ind. Mis.* IX, p. 313, pl. 17. Fig. 1.

Materials examined : 3 ; 2 males and 1 female from Leh in Ladakh region.

It appears to be a very uncommon species. It is a high altitude lizard in the Ladakh region ranging from 3,000 - 3,500m. It coexists with *Agama himalayana.*

5. *Cyrtodactylus stoliczkai* (Karakoram Rock Gecko)
   Gymnodactylus stoliczkai Steindachner (1869). *Reise Novara*

Rept. p.15, pl 2 Fig. II (Type locality : near Karoo, north of Dras, Kashmir).

Materials examined : 6 ; 3 males and 3 females from Kargil and Leh in Ladakh region.

The species is essentially a high altitude lizard restricting itself to the Trans-Himalayan region of Ladakh in Kashmir Himalayas in J&K State. It has not been recovered from Greater, Middle & Outer Himalayan region in Jammu & Kashmir State. It lives under stones along with *Cyrtodactylus lawderanus, Agama himalayana & Phrynocephalus theobaldi.* Some specimens were also spotted on walls and roofs of mud houses in Leh.

6. *Cyrtodactylus lawderanus* (Western Himalayan Rock Gecko)
Gymnodactylus lawderanus Stoliczka (1871). *J. Asiat. Soc.* Beng. p. 194.

Materials examined : 6 ; 1 male and 5 females from Karigil, Bodh Kharbu and Leh in Ladakh region.

Ecological habits are similar to *Cyrtodactylus stoliczkai.* The lizard can be easily distinguished from *Cyrtodactylus stoliczkai* by the tapering tail.

Family : Scincidae

7. *Scincella himalayanum* (Himalayan Ground skink)
Eumeces himalayanus (Gunther) 1864. *Rept. Brit. India,* p. 86, pl. x , fig. 4 (Type locality : W. Himalayas).

Materials examined : 15 ; 4 males and 11 females from Kargil, Bodh Kharbu and Leh in Ladakh region.

It is a terrestrial, diurnal, high mountain lizard.The species is oligothermic and can cope well with very low temperature. Specimens were at Bodh Kharbu (2,700m) and Tajawas Glacier in Sonamarg. (2,970m). Lizards collected near the Tajawas Glacier (Sonamarg) were

found to be quite active during day at very low temperature. Specimens captured from Sonamarg, Kargil and Bodh Kharbu during the month of June carried 3-9 shelled eggs in their oviduct. The average diameter of shelled eggs was 6 x 10 mm. Although Smith (1935) has recorded *S. himalayanum,* as a viviparous species with litters of 3 - 4 young, Duda and Koul (1977) reported it as a ovo-viviparous species which is substantiated by the present findings also.

8. *Scincella ladacense* (Ladakh Ground skink)
Eumeces ladacense (Gunther) 1864. *Rept. Brit. India,* p. 38, pl. x , fig. 1 (Type locality : Ladakh, Kashmir).

Materials examined : 1 female from Bodh Kharbu.

The species is very rare and not much is known about its ecology.

Snakes

Family : Colubridae

1. *Coluber rhodorachis* (The Ladakh Racer)
Zamensis rhodorachis, Jan.(1865) In de Filipps, Pers. p. 356 (Type locality : Iran).

Materials examined : 1 from Khalsi in Ladakh region.

A high mountain species. A single apecimen was collected at an elevation of about 2,700m in Khalsi (Ladakh). Feeds on lizards, rodents and is also reported to feed on other snakes. A very fast running snake and difficult to catch alive.

2. *Elaphe hodgsoni* (Hodgson,s Himalayan Racer)
Spiletes hodgsoni Gunther(1860) F.Z.S, p. 156 Pl. 27 (Type locality : Nepal : London).

Materials examined : 2 ; 1 male and 1 female from Kargil.

A single female measured 350mm in snout-vent length. Specimens were collected during the month of June and July in the vicinity

of water and from the fallen litter. The snake is montane and is found at an elevation of about 2,680m in the Kargil district. Feeds mainly on toad (*Bufo viridis*) and rarely on lizards (skink). The species has also been collected from Greater and Middle Himalayan ranges of Kashmir Himalayas.

3. *Ptyas mucosus* (Dhaman or Rat snake)
Coluber mucosus (Linnaeus) 1758 *Syst. Nat. Ed.* 10, p. 226
(Type locality : India).

Materials examined : 4 ; 2 males and 2 females from Kargil and Khalsi in Ladakh.

A ubiquitous species which frequents grasslands, marshy areas and cultivated fields. It is an excellent climber and a fast runner. Feeds on frogs, fish, lizards, birds and their eggs and rats. It is diurnal, active and ferocious snake. When alarmed, raises its fore body vertically and emits loud hissing sound. It has been collected from the hilly areas of Kargil and Khalsi. The specimens collected from high altitudes were darkly pigmented as compared to specimens from the plains of Jammu. In spite of its vast distribution, there is not much change in the species to warrant subspecies status. It is perhaps the only Indian snake species which is adapted to all sorts of climatic conditions ranging from tropical to temperate to cold-arid zones and from plains to Trans-Himalayan ranges without undergoing any change at species level.

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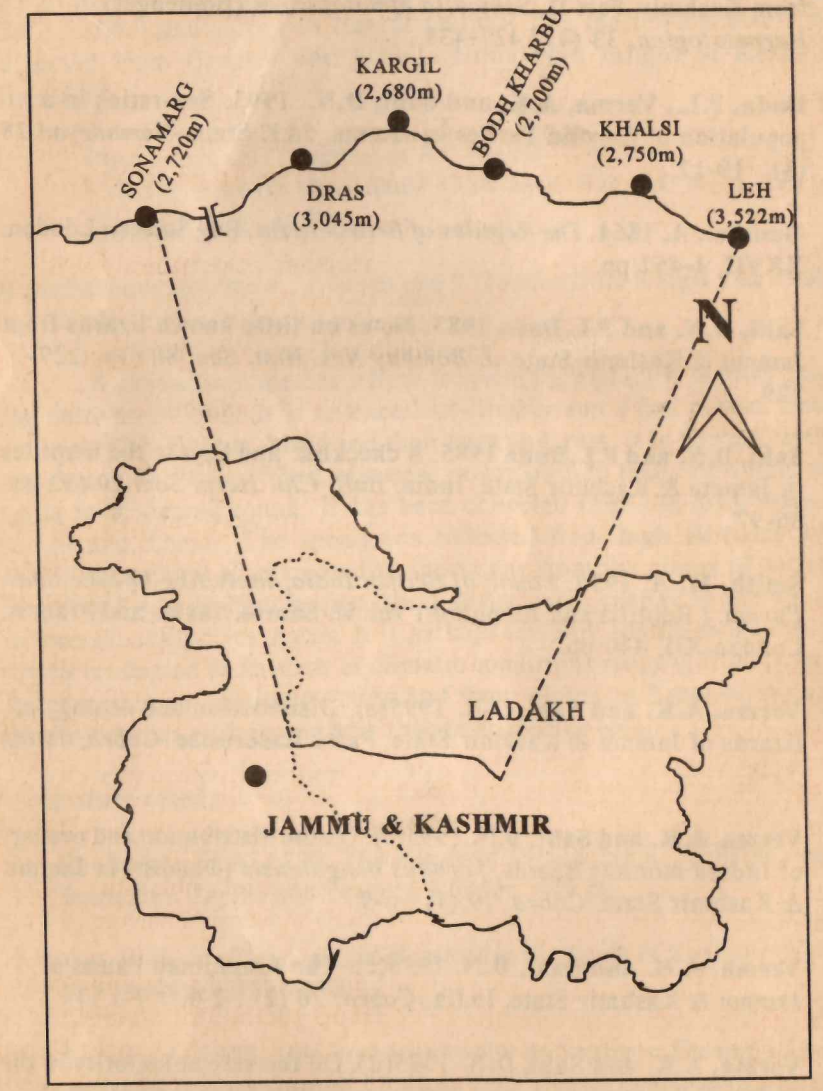
Figure 1 : Map of J & K State showing the places of collection in Ladakh region.



Amphibians of The Parambikulam Wildlife Sanctuary, Kerala.

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Introduction :

The Parambikulam Wildlife Sanctuary located at 10° 20' N - 10° 32' N latitude and 76° 35' E - 76° 51' E longitude and notified in 1973 covers an area of 285 sq. km in the Palakkad (Palghat) district of Kerala State. Only four species of amphibians were known from this sanctuary in literature. Rao (1937) described *Rana parambikulamana* (current nomenclature, *Tomopterna parambikulamana*) from Parambikulam forests (type locality). Satyamurti (1967) reported the occurrence of *Rana leptodactyla* in Parambikulam. Two faunistic surveys conducted by the author and his colleagues in the sanctuary during October - November 1995 and March 1996 resulted in the collection of 12 more species of amphibia. *Tomopterna parambikulamana and Rana leptodactyla* reported earlier from the sanctuary however, could not be obtained during these surveys. For easy diagnosis of the species reported in this account, identification keys are provided below.

The recent taxonomic rearrangement of Indian amphibia both at the generic and at the specific levels proposed by Dutta (1992) is not applied to the species reported in this account, as such changes warrant valid taxonomic explanations along with the suggested changes to qualify recognition.

Systematic List of Amphibians from Parambikulam Wildlife Sanctuary

Class : Amphibia
Order : Anura
family : Bufonidae
Genus : *Bufo* Laurenti

1. *B. parietalis* Boulenger
2. *B. melanostictus* Schneider

Family : Ranidae
Genus : *Nyctibatrachus* Boulenger

3. *N. major* Boulenger

Genus : *Rana* Linnaeus

4. *R. tigerina* (Daudin)
5. *R. cyanophlyctis* Schneider
6. *R. keralensis* Dubois
7. *R. limnocharis* Boisduval
8. *R. leptodactyla* Boulenger
9. *R. beddomii* (Gunther)
10. *R. semipalamata* Boulenger
11. *R. curtipes* Jerdon
12. *R. temporalis* (Gunther)

Genus : *Tomopterna* Dumeril & Bibron

13. *T. rufescens* (Jerdon)
14. *T. parambikulamana* (Rao)

Family : Rhacophoridae
Genus : *Philautus* Gistel

15. *P. leucorhinus* (Lichtenstein & Martens)
16. *P. chalzodes* (Gunther)

Systematic Account :

Key to the families of Amphibia from Parambikulam Wildlife Sanctuary

1. Upper jaw teethed ; tongue bifid.....2.
   Upper jaw teethless : tongue entire, pyriform.....Bufonidae.

2. Digits with an intercalary cartilage between penultimate and terminal phalanges ; fingers minutely to fully webbed.....Rhacophoridae.

3. Digits without an intercalary cartilage between penultimate and terminal phalanges ; fingers free.....Ranidae.

Key to the species of *Bufo* laurenti (family : Bufonidae) from Parambikulam Wildlife Sanctuary

Partial ridges present ; first finger longer than second.....*parietalis.*
Partial ridges absent ; first finger equal to or longer than second ; tympanum nearly two-thirds of the eye.....*melanostictus.*

1. *Bufo parietalis* (Boulenger)
   Materials examined : 3 exs. Orukomban range. 1-xi to 6-xi-1995.
   Snout to vent length : 46 - 62mm.

2. *Bufo melanostictus* Schneider
   Materials examined : 6 exs. Sungam, Parambikulam &Orukomban ranges. 30-x to 6-xi-1995 and 16-iii-1996.
   Snout to vent length : 26 - 77mm.

Key to the genera of family Ranidae from Parambikulam Wildlife Sanctuary.

1. Pupil horizontal or roundish-subtriangular ; skin of back smooth or with longitudinal glandular folds, tubercles or warts but never wrinkled with vermiform folds.....2.
   Pupil vertical ; skin of back wrinkled with vermiform folds.....*Nyctibatrachus.*

2. Outer metatarsals united completely or feebly separated at the distal end ; inner metatarsal tubercle enlarged, usually shovel-shaped or crescentic.....*Tomopterna*.
Outer metatarsals separated by web upto base or at least in the distal half ; inner metatarsal tubercle comparatively smaller, blunt or finger-like or compressed.....*Rana*.

Key to the identification of *Nyctibatrachus major* Boulenger.

Toes three-fourths to nearly fully webbed ; finger tips merely swollen and without circum marginal grooves.....*Nyctibatrachus major*.

3. *Nyctibatrachus major* Boulenger
Materials examined : 4 exs. Sungam and Karimala ranges. 27-x-1995 and 18-iii-1996.
Snout to vent length : 14 - 36mm.

Key to the species of *Rana* Linnaeus from Parambikulam Wildlife Sanctuary.

1. Discs of the toe tips is present without groove.....2.
Discs of the toe tips with a crescentic circum-marginal groove.....5.
2. Toes completely webbed.....3.
Toes incompletely webbed.....4.
3. Skin of back with longitudinal folds ; inner metatarsal tubercle comparatively smaller, blunt; heels overlap when the legs are folded at right angles to the body.....*tigerina*.
Skin of back warty ; inner metatarsal tubercle finger-like.....*cyanophlyctis*.

4. Toes three-fourths webbed; two phalanges of fourth toe free; outer metatarsal separated by web nearly to base; tibio-tarsal articulation reaches nostril or tip of snout.....*keralensis*.
Toes half webbed; three phalanges of the fourth toe free; outer metatarsal united in the basal half; tibio-tarsal articulation reaches nostril.....*limnocharis*.

5. Tongue with a pointed papilla.....6.
Tongue without a papilla; outer metatarsal usually seperated by a web to base.....8.

6. Toes half to two-thirds webbed.....7.
Toes not more than one-fourth webbed; tympanum very distinct; loreal region very oblique; skin of head smooth and of back with short longitudinal folds; no lumbar spot.....*leptodactyla*.

7. First finger at least as long as second; tympanum half to two-thirds the diameter of eye; web extending to disc on fifth toe.....*bedomii*.
First finger longer than second; tympanum as large as eye and close to it; web extends to the distal sub articular tubercle of the fifth toe.....*semipalamata*.

8. Disc of fingers, if present, without groove or the groove indistinct; a prominent glandular fold behind the tympanum down to the shoulder present; tibio-tarsal articulation reaching the tympanum or eye.....*curtipes*.
Disc of fingers with circum-marginal groove; no glandular fold behind the tympanum down to the shoulder; tibio-tarsal articulation reaching the nostril or tip of snout or a little beyond; limbs with dark brown cross bands.....*temporalis*.

4 *Rana tigerina* (Daudin)
Material examined : 1 ex. Sungam range. 15-iii-1996.
Snout to vent length : 150mm.

5 *Rana cyanophlyctis* Schneider
Material examined : 5 exs. Sungam and Orukomban ranges. 27-x to 29-x-1995 and 14-iii to 15-iii-1996.
Snout to vent length : 23 - 53mm.

6 *Rana keralensis* Dubois
Material examined : 12 exs. Sungam Parambikulam and Orukomban ranges. 27-x to 6-xi-1995 and 14 to 16-iii-1996.
Snout to vent length : 11 - 54mm.

7 *Rana limnocharis* Boisduval
Material examined : 2 exs. Sungam & Parambikulam ranges. 31-x-1995 and 15-iii-1996.
Snout to vent length : 18 - 32mm.

8 *Rana leptodactyla* Boulenger
Material examined : None (though reported earlier from the sanctuary, the species could not be obtained during the current surveys).

9 *Rana beddomii* (Gunther)
Material examined : 7 exs. Sungam, Parambikulam & Orukomban ranges. 27-x to 6-xi-1995.
Snout to vent length : 17 - 39mm.

10 *Rana semipalmata* Boulenger
Material examined : 3 exs. Sungam, range. 27-x to 4-xi-1995.
Snout to vent length : 20 - 25mm.

11 *Rana curtipes* Jerdon
Material examined : 2 exs. Sungam, Parambikulam & Orukomban ranges.
Snout to vent length : 61& 76mm.

12 *Rana temporalis* (Gunther)
Material examined : 4 exs. Sungam & Orukomban ranges. 27-x to 1-xi-1995 and 14-iii to 20-iii-1996.
Snout to vent length : 16 - 56mm.

Key to the species of *Tomopterna* Dumeril & Bibron from Parambikulam Wildlife Sanctuary.

An outer metatarsal tubercle present; tibio-tarsal articulation reaches tympanum or posterior border of the eye; tympanum distinct, about half or slightly over half the diameter of the eye; snout rounded; first finger much longer than second.....*rufescens*.
Outer metatarsal tubercle inconspicuous; tibio-tarsal articulation extends far beyond the tip of snout; tympanum indistinct, two-fifths the diameter

of eye; snout pointed; first finger equal to the second....*parambikulamana*.

(13) *Tomopterna rufescens* (Jerdon)
Material examined : 5 exs. Sungam, Parambikulam & Orukomban ranges. 27-x to 6-xi-1995.
Snout to vent length : 23 - 33mm.

(14) *Tomopterna parambikulamana* (Rao)
Material examined : Non (though described earlier from the sanctuary, the species could not be obtained during the current surveys).

Key to the species of *Philautus* Gistel from Parambikulam Wildlife Sanctuary

Tongue without papilla; snout acuminate, a little longer than the diameter of the orbit; canthus rostralis distinct; tympanum distinct, half diameter of eye; toes one-third or half webbed; discs and sub-articular tubercles moderate; fingers very slightly webbed.....*leucorhinus*.
Tongue with a median conical papilla; snout rounded, as long as the diameter of the orbit; canthus rostralis indistinct; tympanum small, hidden; toes half webbed; discs well developed; sub-articular tubercles double under the second and fourth fingers; fingers free.....*chalzodes*.

(15) *Philautus leucorhinus* (Lichtenstein & Martens)
Material examined : 5 exs. Sungam, Parambikulam & Orukomban ranges. 30-x to 6-xi-1995.
Snout to vent length : 9 - 21mm.

(16) *Philautus chalzodes* (Gunther)
Material examined : 1 ex. Orukomban range. 1-xi-1995.
Snout to vent length : 23mm.

Acknowledgement :

The author is grateful to the director, Zoological Survey of India, Calcutta for facilities and encouragement and to the officials of the Forest Department, Government of Kerala for the help and cooperation rendered during the surveys.

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Observations on Breeding of Mugger (*Crocodilus palustris*) at the Nandankanan Zoological Park, Orissa

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Orissa is the only State in the country having all the three species of Indian Crocodilians (*Gavialis gangeticus, Crocodilus porosus* and *Crocodilus palustris*). As the population of all the three species were dwindling in the natural habitats of Orissa, a special conservation-oriented research project was initiated during the year 1975-76. Under this project a captive breeding programme for all three species was taken up at the Nandakanan Zoological Park, Orissa from 1975-76 by the State Forest Department, with assistance from Government of India and F.A.O./ U.N.D.P. This communication is intended to place on record some of the observations made on the breeding of mugger (*Crocodilus plaustris*) at the Nandanakanan zoological Park, Orissa.

For the first time, the park procured two young mugger from Alipore Zoological Garden, Calcutta on 02.01. 1964. Unfortunatelly one died on 15.03.1964 and other escaped into the near by lake on 10.05.1965. Since then , five young mugger were recieved from different parts of Orissa (two specimens from river Mahanadi on 02.11.1964 and 15.05.1967, one from Balimela reservoir in Koraput district on

27.03.1977 and two specimens from reservoirs in Ganjam district on 05.05.1983 and 23.12.1984). All these specimens died within few months of their arrival. This species used to occur previously in Brahmani, Baitarani, Mahanadi, Sileru and hill streams in Mayurbhanj district including Budhabalang, Khiri and Bhandan and the population has been greatly depleted in Orissa (Kanungo, 1976). The occurence of this species in Ganjam district is being reported for the first time in this communication.

Breeding pool :

A special mugger breeding pool was constructed inside the park during 1978-79. The pool measures 38 m at the longest part and 17 m at the widest part with a depth of 2 m. The pool has the capacity to hold 8,26,000 litres of water. The land area of the pool complex is about 1,250 sq.m. with suitable vegetation. A compound wall of 2.1m high was erected all around except 23m on the viewer's side with 0.6m high parapet. A dry moat was provided on this side to discourage the mugger coming near the visitors. There is provision for removing the stagnant water and refilling with fresh water from the near-by lake.

Breeding population :

Two adult males and three female mugger procured from Tamilnadu were released in this pool in January, 1979. To these, four more (2 males & 2 females) mugger of Tamilnadu origin were added in October, 1980. However, one male and one female died in October,1980 and January, 1981 respectively leaving three males and four females in the breeding pool.

Breeding :

The details of egg laying, clutch size and hatching recorded in the park from 1981 to 1992 are appended in Table-1.

Table-1 : Details of Mugger breeding .

Sl. No.	Date of egg-laying	Female mugger number	Clutch size	Date of hatching (incubation period in days)	No. of hatch-lings.	Remarks
1.	March '81	1	29	did not hatch	-	All eggs infertile.
2.	08.03.82	1	30	16.05.82 (73)	5	23 eggs were broken and soiled. 2 did not hatch.
3.	05.03.83	2	22	20.05.82 (74)	2	7 eggs were broken & soiled. Rest (13) did not hatch.
4.	05.03.83	1	29	29.05.83 (86)	4	Rest did not hatch.
5.	05.03.83	3	25	25.05.83 (82)	13	Rest did not hatch.
6.	08.03.83	2	16	25.05.83 (79)	5	Rest did not hatch.
7.	05.03.84	1	24	19.05.84 (76)	10	Rest did not hatch.
8.	10.03.84	3	20	20.05.84 (72) & 22.05.84 (74)	14	Rest did not hatch.
9.	12.03.85	1	4	did not hatch.	-	All eggs were spoiled.

Table 1. (Continued)

Sl. No.	Date of egg-laying	Female mugger number	Clutch size	Date of hatching (incubation period in days)	No. of hatch-lings.	Remarks
10.	14.03.85	2	19	did not hatch	-	All eggs were spoiled.
		During 1986,1987 & 1988 no egg laying were recorded.				
11.	04.03.89	1	17	31.05.89 (89) 01.06.89 (90) 02.06.89 (91)	9	Rest did not hatch.
12.	01.03.90	1	20	did not hatch.	-	All egge were spoiled.
13.	04.03.91	1	12	04.06.91 (93) 06.06.91 (95)	3	2 eggs were spoiled. Rest 7 did not hatch.
14.	10.03.92	1	23	28.05.92 (80) 09.06.92 (92)	17	Rest did not hatch.
TOTAL	-	-	290	-	82	-

The study of the table reveals that the eggs were laid invariably during March and the eggs hatched from mid-May to early June (16th May to 9th June). 290 eggs were laid in 14 clutches with a mean of 20.7 eggs. 82 hatchlings hatched out of these 290 eggs (percentage of hatching is 28.3). Incubation period recorded in 10 cases varied from 72 to 95 days with a mean of 81.3 days. This variation of incubation period recorded in different years may be due to the influence of local climatic conditions.

The egg size recorded in April, 1990 and 1991 in 30 cases varied from 7.0 - 8.2 X 4.2 - 5.1 cm.

The nests observed twice in April, 1990 and April, 1991 were at a distance of 8.4m. and 8.2m from the water edge, respectively. The nests were more or less circular with an average diameter of 50 cm and with depth varying between 19 & 25 cm.

The three hatchlings hatched in June, 1991 measured 27.0 - 27.5 cm in total length and tail lengths varied from 13.5 to 14.0cm. The weights were 80 gm in two cases and 90 gm in one case.

According to Daniel (1983) the female mugger lays her eggs (3 to 40 or more in a clutch) in a pitcher shaped hole about 50 cm deep and 30 cm in diameter and about 2 to 500 m away from water. The egg size varies from 7.0 X 5.0 to 8.0 X 5.0 cm. He further states that the incubation period is slightly in excess of two months but may go upto 90 days depending on the prevailling temperature which agrees with the present observations.

In an earlier report the egg size of 10 eggs ranged between 7.2 X 3.8 to 8.0 X 4.0 cm (Whitaker & Whitaker, 1978).

Female mugger lay an average of 25 - 30 eggs in holes within 10 m of the water. Incubation averages 66 days and hatchlings averaged 27cm in total length (Whitaker & Whitaker, 1984). At Jeypore Zoo, a female mugger nested between 25th April and 22 May and hatching occured between 26th June and 6th July during the period 1967 to 1971 (Prakash, 1971). The breeding season in mugger is November to June in

South India and a month later in the North ((Whitaker & Whitaker, 1984). One of the nests of a female mugger in captivity had 28 eggs and had the longest incubation period of 117 days (Daniel *et. al.* 1991). They had attributed the cause of longer duration of incubation to shade above nest and prolonged cool weather.

Congenital Anamoly :

Out of 82 hatchlings observed over the period in the Park, one hatched on 04.06.91 was blind (1.2 %) with no trace of development of the eyes. Soon after hatching it weighed 90 gm and measured 27.5 cm in total length, tail length alone was 14.0cm. Singh (1995) reported two cases of eye defect with poor vision as evident from poor responses to stimuli. Conginetal deformities related to longer incubation period in this species have been reported from Orissa (Singh and Sagar, 1992). The blind mugger hatchling in the park hatched after longer incubation period of 93 days which agrees with the findings of Singh and Sagar (1992). Singh and Rout (1995) reported a case of twinning abnormality in mugger from Orissa.

Mortality :

Out of 62 hatchlings that hatched during the period from 1982 to 1989, 9 died within 6 months of age, 10 died within 7 to 12 months of age and 21 died within 2 to 5th year of age (total- 40).

Two hatchlings of 10 days age were accidentally devoured by a juvenile saltwater crocodile of the adjacent yearling pool. Almost all the 27 mugger of 2nd to 5th year of age died from traumatic injuries resulting from infighting probably due to insufficient space and shifting from one enclosure to another. The other causes of death were egg-yolk peritoniatis (1), debility (1), stress (3), pneumonia (7), gastroenteritis and hepatitis (3) and toxaemia (2).

Bustard (1980) reported the commonest diseases of hatchlings/ young crocodiles in general as gastroenteritis, mouth cancer, injuries resulting from fighting and dehydration and resultant emaciation. Out of 434 mugger reared at the Crocodile Breeding Centre, Tadoba

(Maharastra) during the period of 1977 to 1992, 213 (49.1 %) died (Khawarey, 1995).

Rehabilitation of Mugger :

Twelve park-bred mugger of over one metre in length were released in the hill streams inside Similipal Tiger Reserve under rehabilitation programme on 23.02.88. Similarly, two mugger have been realeased in the Kumarkunti reservoir on 19.11.90 and two were released into Ambilopokhari tank on 30.01.96 inside Chandaka-Dampara Wildlife Sanctuary. Out of 434 mugger reared at Crocodile Breeding Centre, Tadoba (Maharastra), 126 were released into nine wetlands located mostly in protected areas (Kharwarey, 1995).

Supply to other zoos :

Two mugger were supplied to Sepahizala Zoological Park (Tripura) on 24 April 1985, one mugger to Kapilash Deer Park (Orissa) on 13 September 1985 and four mugger were supplied to Jawaharlal Nehru Biological Park, Bokaro Steel City (Bihar) on 5 Febuary 1990.

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Housing of Snakes

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Introduction :

In India most of the zoological parks have serpentarium / vivarium / terrarium to exhibit snakes for education and captive breeding. However, except for a few zoos, most of them are not successful in rearing snakes in captivity.

Zoological parks are now considered breeding and education centres for various rare and endangered species. In these circumstances, indiscriminate collection of large number of snakes just for exhibition and entertainment by the zoo / park results in depletion of wild population, at least locally.

Snakes are cold blooded animals, generally falling into one of the following categories :

1. Terrestrial
2. Arboreal
3. Aquatic (freshwater and marine)
4. Fossorial

Housing of snakes, requires specially designed cages. Before construction of serpentarium the following points should be taken into account.

1. Keeping all snakes together in an enclosure should be avoided.
2. Each species of snake requires different type of resources. So it is advisable to put only snakes of the same species together.
3. Some species may be susceptible to epidemic diseases which may in turn lead to loss of the entire stock.
4. Keeping snakes in separate enclosures should be helpful for proper feeding and veterinary care.
5. As an aid to education, housing snakes in separate cages with suitable display boards enrich the value.
6. Keeping in separate cages with suitable environment may enhance the longivity of snakes in captivity.
7. Collecting and housing of large number of snakes leads to shortage of food and veterinary care and ultimately loss of stock.

Housing fossorial snakes :

There are two fossorial snakes namely, common sand boa and red sand boa which are ideal to keep in vivarium. Other snakes like *Typhlops* sp. and *Uropeltids* are habitat and food specialists which are very difficult to keep in zoos.

Horizontal cages with glass frontage of 1m X 0.6m X 0.6m may be suitable for housing the two species. A service door should be at the rear side. The lateral sides and the top can be fixed with aluminium perforated mesh for cross-ventilation. The cage should be filled with river sand for about 5 cm thickness. If ther is more of sand the visitors cannot see the animals, since they burrow into the soil. Small size water trough is enough for these species. Diagram 1 shows the details of cage for fossorial snakes.

Housing terrestrial snakes :

Terrestrial snakes may be classified into small and large snakes. The smaller snakes such as wolf snake, kukri snake, cat snake and banded racer can be housed in horizontal cages which are very similar to fossorial snakes.

The larger snakes such as rat snake, trinket snake, cobra, kraits and vipers require bigger open space. 1m X 1m X 1m sized cages with glass front bottom covered with river sand, will be ideal to house these large terrestrial snakes. A small water trough and potted green plants should be placed. The plant should be sturdy such as cactus and orchids and should be replaced as and when necessary. Diagram 2 shows details of cage for terrestrial snakes.

Python requires vast space (2m X 1m X 1m). Undulating terrain with water trough will be suitable to house medium sized pythons. Large pythons exceeding 4 m in length will require larger cages (4m X 2m X 2m). A cement water trough, not less than 2 feet in diameter and 1 foot deep and smooth enough should be sunk in a corner. The rim of the trough should be not over 10 cm high above the surface of the cage. The floor of the trough should be sloped towards the rear of the cage so as to facilitate drainage and cleaning.

Housing arboreal snakes :

The cages for arboreal snakes such as tree snake, vine snake and flying snake should be constructed in a vertical shape of 1m X 0.5m X 1.5m size with glass front. Potted plants and a small water bowl are a must for arboreal snakes. The bottom of the cage should be covered with sand, and a small piece of hollow bamboo should be provided to facilitate egg laying and roosting respectively. Diagram 3 shows details for housing arboreal snakes.

Housing aquatic snakes :

Aquatic snakes can be clssified further into fresh water and marine snakes. Generally fresh water snakes are found near the edges of waterbodies in nature. So the cage should have both aquatic media and terrestrial substratum. The size of the cage should be similar to larger terrestrial snakes. The suggested design is shown in Diagram 4. A small water trough of semicircular nature 0.5 m radius can be constructed with a glass front. Rest of the area to be filled with river sand so that the visitors can see the animals either in water or on the sand. Small water plants may enrich the cage.

As sea water is highly corrosive, large glass tanks (1.5m X 0.5m X 0.5m) sealed with non-toxic and non-corrodible silicon rubber adhesive are ideal for housing marine snakes. Water filter should be provided at the bottom of the tank. Bottom of the tank is to be lined with stones, shells, corals, etc. Filtered sea water should be provided and changed once every week. Lights are to be fitted on the top of the aquarium to illuminate the tank.

The following are some important points to be noted while housing snakes.

1. Glass front should be provided. Do not use welded mesh door or wire mesh front which can cause damage to snakes. Visitors also tend to poke the animals with small sticks. Glass fronts enhance the beauty of the cages and also enable visitors to see the animals without any obstacle.

2. A service door on the rear side of the cage makes maintenance easy.

3. All internal walls to be smoothly plastered with the corners and wall junctions rounded to prevent snakes from climbing. The roof of the enclosure should be covered with aluminium perforated sheets. A thatched roof should be constructed over the cage to avoid rain water getting into the cage in wet regions.

4. Perforated sheets (0.25m X 0.25m) may be fixed to the lateral walls for cross ventilation.

5. A dead tree branch is to be placed in the cage upon which the animals can climb. One or two large, smooth edged rocks should also be placed inside the cage to aid the snake when skin sloughing takes place.

6. Water trough is to be drained, flushed and re-filled daily.

7. Cages to be checked at least once daily for faeces, shed skin etc., which should be removed. Contiminated floor or bedding are to be cleaned immediately.

8. A heat system shall be built on the floor or the cealing of the cage, preferably with temperature control device. If not, a pot shall be placed inverted with facility for fixing a 25 W bulb inside it. When the ambient temperature falls below 29° C the bulb can be switched on to provide the needed warmth.

9. The surface soil should be removed every week and fresh earth should be re-filled to avoid infection due to defecation and urination.

10. During summer, water may be sprayed on potted plants and floor to keep the cage moist.

11. Above the glass front, a flourescent light should be fixed for illumination.

12. Glass front should be fixed at an angle so as to minimise reflection from outside the cage.

13. Cage temperature should be monitored using max-min thermometers.

Exercise pit :

Most of the captive animals are kept in closed enclosures. Large snakes need free movement. To this effect, an exercise pit measuring 5m X 2.5m and a height of 1.5m should be constructed. Snakes from the cages are to be allowed into this pit regularly for free movement. This pit must be cordoned off from visitors.

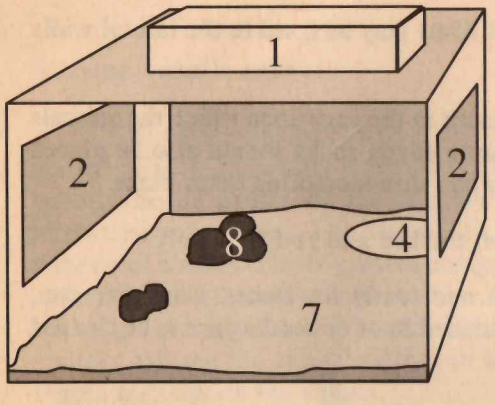
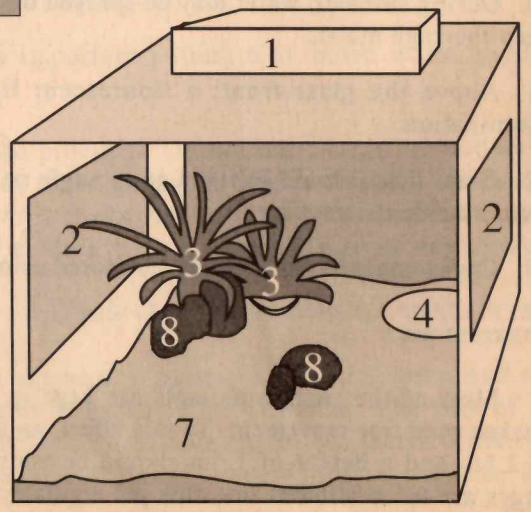


Diagram 1 : Housing for fossorial snakes.
Size :
1m X 0.6m x 0.6m.

Diagram 2 : Housing for terrestrial snakes.
Size 1m x 1m x 1m.



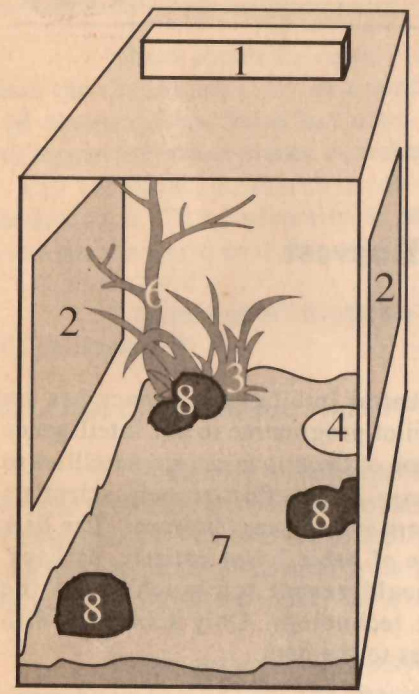
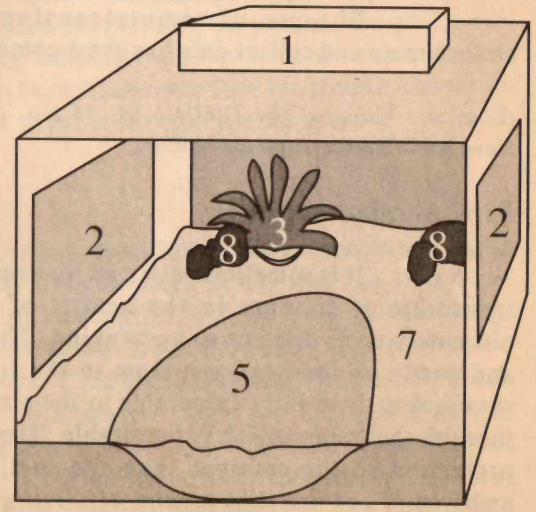


Diagram 3 : Housing for arboreal snakes.
Size 1m x 0.5m x 1.5m.

Legend :

1 Fluorescent light
2 Side ventilator windows
3 Potted plants
4 Drinking water trough
5 Water trough for aquatic snakes
6 Dry branch for terrestrial snakes
7 Earth soil / sand
8 Rocks / pebbles

Diagram 4 :
Housing for aquatic snakes.
Size 1m x 1m x 1m.



Random Harvest

CIA spies on Tortoises :

Believe it or not, the Central Intelligence Agency has six environmental projects as part of a pilot programme to use intelligence technology for ecological pursuits. One of them is to use spy satellites to study the habitat of the desert tortoise in an effort to help scientists preserve this threatened species. There is one snag, however. The data collected is treated as 'secret'. Force of habit ? Not entirely, perhaps. CIA fears that the information could reveal too much about the capabilities of U.S. reconnaissance technology. Only scientists with security clearances are allowed access to the data.

The use of remote sensing techniques to study the environment and collect data has great potential in wildlife conservation.

(Source : Voice of the Turtle, Vol. 25 No. 11. Based on a report in The New York Times, May 14, 1996)

Early warning system :

It is sometimes claimed that amphibians are good biological indicators of changes in the quality of the environment that may ultimately spell disaster to humankind. Their life cycle partly in water and partly on land exposes them to the rigors of both. Their hairless skin makes them fully vulnerable to the atmosphere. Gases readily flow through their skin which is permeable. Their jelly-coated eggs give less protection to the embryos than the shells covering most vertebrate embryos. They are thus a kind of "living barometers" for the earth's environmental health.

Now comes the news (*The Indian Express*, 28 Jan. 1997) about the chance discovery in a pond in Minnesota in the U.S. of frogs with abnormalities. Some had extra eyes, some had extra limbs, some had legs in the wrong places. A preliminary survey showed up such frogs in 150 locations. Research is on to find out the reasons for this phenomenon. The University of Minnesota has sought the help of scientists the world over through internet.

Memories of Hiroshima - Nagasaki, Chernobyl ? Memories of Thalidomide ?

From ryot's friend to riot control :

Snakes are widely regarded as highly beneficial to agriculture because they keep the rodent population in check. In India alone10 25% of foodgrains is lost because of destruction by rats in the field and in the godowns. Without the natural predators of rats like snakes and owls etc., the position would have been far worse.

But snakes seem to have other uses too. A news item in the *Indian Express* of 18 Jan. 1997 quotes the head of the police at Bekasi on the outskirts of Jakarta, Indonesia for the information that the police are training cobras including king cobras as aids to control rioters. Police men with the deadly snakes in their hands will face the rioters and try to scare them away. The method is yet to become operational.

Meet on Crocs :

Information has been received from the crocodile specialist group of the Species Survival Commission / IUCN that the first West Asia Regional Conference on Crocodiles will be held at the Jiwaji University, Gwalior, India from the 5th to 7th June 1997. The conference is being organised by the Madras Crocodile Bank and The Zoo Outreach Organisation / CBSG, India with support from the People's Trust for Endangered species, U.K. Those who wish to participate in the conference may get in touch with Sajani Cherian, Centre for Herpetology, Madras Crocodile Bank, Post Bag No. 4 Mammallapuram, Pin 603 104, South India.

And a drop of poetry.

The Spanish poet, Garcia Lorca, has somewhere described a garden lizard as " a drop of crocodile". Can any reader help in locating the exact source ?

B.Vijayaraghavan

There is a story, perhaps apocryphal, about the distinguished British biologist. J. B. S. Haldane, who found himself in the company of a group of theologians. On being asked what one could conclude as to the nature of the Creator from a study of his creation, Haldane is said to have answered, "An inordinate fondness for beetles".

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AIMS AND OBJECTIVES OF

MADRAS SNAKE PARK TRUST

i) To maintain and display a captive collection of snakes and other reptiles as a means of education of the public.

ii) To promote knowledge on snakes and other reptiles and dispel the erroneous beliefs about them.

iii) To undertake captive breeding of vulnerable species of snakes and other reptiles.

iv) To aid and assist research in herpetology.

v) To provide facilities for the identification and classification of snakes and other reptiles and, for this purpose, maintain a museum of study collections.

vi) To maintain a library of books and other literature on herpetology.

vii) To publish scientific and semi- scientific literature on snakes and other reptiles.

viii) To undertake survey on the distribution and status of snakes and other reptiles.

ix) To provide consultancy services on snakes and other reptiles.

x) To provide a common forum for amateur herpetologists to interact.