

REVIEW OF THE CURRENT DIVERSITY AND RICHNESS OF AMPHIBIANS OF GUJARAT, INDIA

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Introduction

“Amphibian” is a Greek construction, meaning “double life” – a reference to the fact that the typical amphibian lifecycle is partly aquatic and partly terrestrial. That can make amphibians double vulnerable : disturbance of either water or land can affect them. Therefore amphibians are the most threatened vertebrates in the animal world.

Today it is observed that amphibians are declining on a global scale. Six significant threats to amphibian populations are

- (a) habitat loss and degradation,
- (b) introduced invasive species,
- (c) environmental pollution,
- (d) disease,
- (e) unsustainable use, and
- (f) global climate change.

These threats are resulting in the depletion of more and more numbers of amphibian populations. On the other hand every year new species of amphibians are discovered as a novelty for science. Such a contradicting situation persuades us towards deep thinking about its conservation, which is only possible when we know about the diversity and current status of the amphibians from specific areas. The same attempt has been made in this study.

Study Area

Gujarat State

Gujarat State is situated on the West Coast of India between 20° 6' to 20° 42' North latitudes and 68° 10' to 74° 28' East longitudes. It is bound by the Arabian Sea in the West, by the state of Rajasthan in the North and North-East, by Madhya Pradesh in the East and by Maharashtra in the South and South-East. The state has an international boundary and has common border with the Pakistan at the North-western fringe.

Gujarat State has an area of 1.96 lakh km², which makes for 5.98 % of land area of the country. The state is administratively divided into 25 districts and further it is divided into 223 talukas and 17,880 have villages. Also the physical features of the state indicate the following five distinct physiographic units based upon relief, slope and landforms, soil, drainage pattern, climatic variation and agricultural development.

South Gujarat : Valsad, Navsari, Dangs and some part of Surat District (areas to the South of river Tapi). This part of Gujarat is known as an influent area of Western Ghats.

North Gujarat : Banaskantha, Patan,

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Mahesana, Sabarkantha and Gandhinagar influent by Arravali hills.

Saurashtra Peninsula : Jamnagar, Porbandar, Junagadh, Amreli, Bhavnagar, Rajkot, Surendranagar and part of Ahmedabad (part areas of West of river Sabarmati). Arabian Sea and Gulf of Khambhat and Kachchh are bound to this peninsula. The north and eastern boundaries of the peninsula are connected with the main land, consisting of the low land depression of Nal Sarover (a natural wetland).

Kachchh : Kachchh District including Rann of Kuchchh (greater and little).

Climate

Climate of the state is moderate with three distinct seasons, June to September – monsoon, October to January – winter and February to May – summer. The maximum temperature in the year occurs in May (up to 45°C) and drops up to around 4°C in the month of January.

The relative humidity in all parts of the state is comparatively low and recorded as 50% between October to May. This is not applicable to coastal areas, where the moisture content of the atmosphere is moderately high all the round year with a maximum in the summer months. The relative humidity shows wide variations during the day in the interior parts of the state.

Gujarat receives most of its rainfall from the South-West monsoon between June and September. The monsoon starts in June and reaches its maximum intensity in July and August. These are the rainiest months of the year and the showers taper

off towards the end of September. While occasional showers occur in the month of October. Last few years data shows that state also suffered from a drought every five years.

The large area of the state and distinct five physio-graphic units affect the climate of the state and it results in regional variations of climatic conditions. Rainfall is high in South Gujarat in comparison to North Gujarat and Kachchh areas. Annual total rainfall decreases as you proceed from South to North in the state. The temperature (average : maximum-minimum) variation increases as you proceed from South to North in the state.

Forests of the State

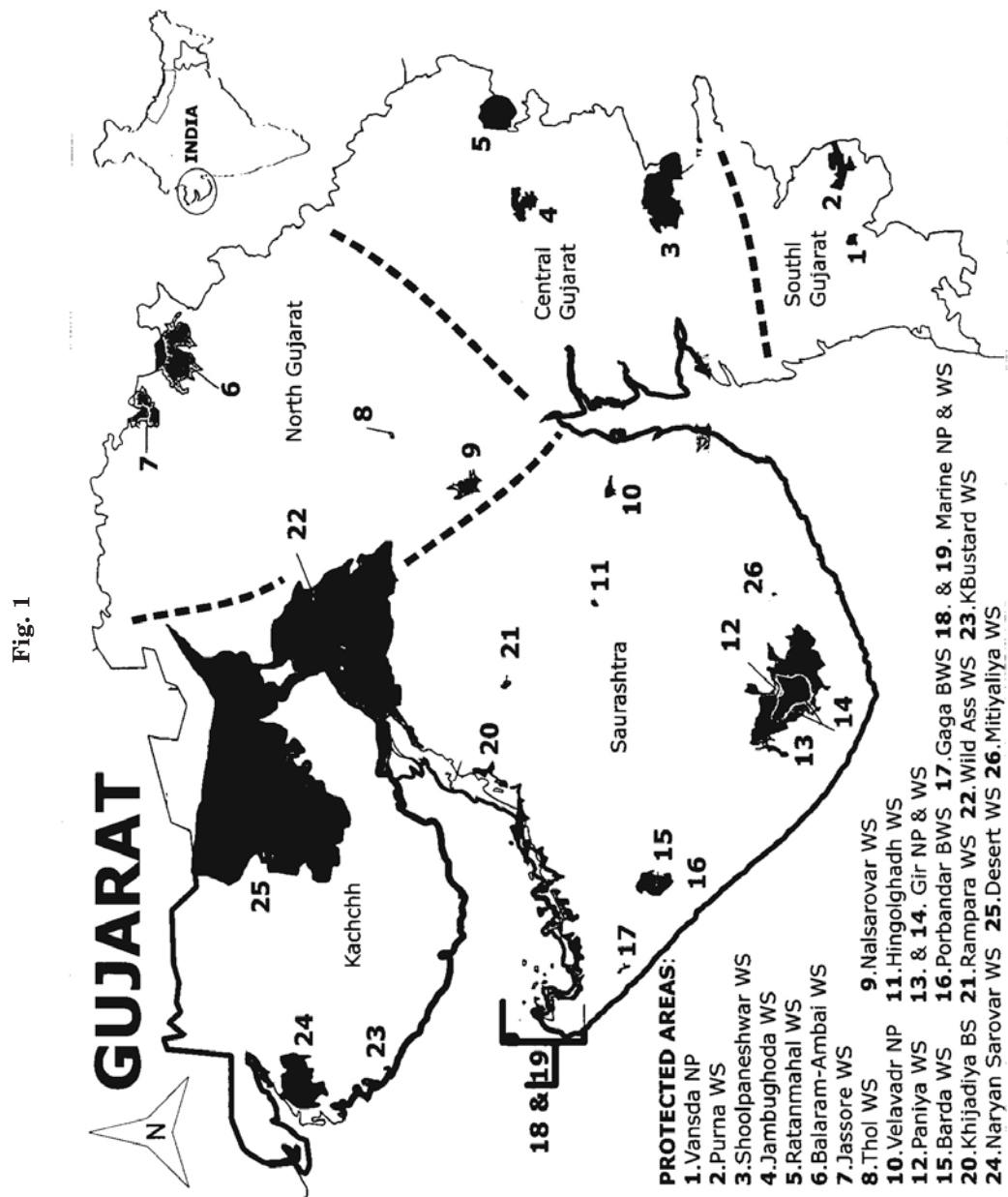
At present there are a total 26 National Parks and Sanctuaries in the state (Fig. 1). All the protected areas are protected under the Wildlife Protection Act, 1972 and cover 16920.6 km² area of forests and 8.62 % (approximately) area of the state, excluding the other unclassified 1909.7 km² of forests.

As per the classification of Champion and Seth (1968), the forests of the state are further classified habitat-wise as :

- (1) 3B - South Indian moist deciduous forest,
- (2) 4B - Swamp forests,
- (3) 5A - Southern tropical dry deciduous forests, and
- (4) 6B - Northern tropical thorn forests.

Methodology

A detailed field survey was made in various parts of Gujarat State during the last eight years (1998 to 2005), including protected areas (PAs) for assembling



Map of Gujarat showing location of Protected Areas with physiographic zones of the State

baseline information regarding amphibians. The aim was to know the actual numbers and status of inhabitant amphibian species in various parts of the state. Also an effort has been made by me to determine about the prevalence of threats to the amphibian fauna.

Total 24 Protected Areas out of 26 PAs are explored especially during the rainy seasons to know the present richness and status of amphibians in these areas (Table 1). Four National Parks and twelve Wildlife Sanctuaries have been extensively explored and remaining has been visited (once to twice) for the search of amphibians and to gather base line information on the subject. It has not been possible to collect the baseline information on amphibians from the two PAs namely Nal Sarovar Bird Wildlife Sanctuary and Pania Wildlife Sanctuary.

All collected amphibian specimens were examined carefully and identified by using the diagnostic keys, given by Boulenger (1890, 1920) and Daniel (1963a, b, 1975) and Daniels (1997, 2005) and the nomenclatures adopted is Datta (1997) and Das and Dutta (1998).

Results and Discussion

Species Account : Total 20 species of amphibians belonging to two orders; five families and 13 genera are recorded, including a species of caecilian and nineteen species of frogs and toads. Present survey indicates that the state has a very poor amphibian fauna with respect to other neighbouring states of Maharashtra (45 species: Padhye and Ghate, 2002) and richer than Madhya Pradesh (18 species : Chandra and Gajbe, 2005) and Rajasthan (9 species : Sharma, 1995).

Species Richness and Diversity : Two forms of amphibian are recorded including Gymnophina (Caecilian) and Anura (frogs and toads). Total five families of amphibians were recorded with a highest of 10 number of Ranaide species followed by five species of Microhylidae family; three species of Bufonidae and the remaining two species are Ichthyophiidae and Rhacophoridae.

The richness and diversity of the state is to be observed with the correlated rainfall pattern. High diversity of amphibians is recorded at Vansda National Park and Purna Wildlife Sanctuary of South Gujarat with 17 and 18 species respectably. And very low diversity of amphibians was recorded at Kachchh Desert Wildlife Sanctuary and Narayan Sarovar Wildlife Sanctuary with 5 and 8 species respectively. The list of species and it's status at various protected areas are mentioned in Table 2. High numbers of amphibians with 18 species are found in South Gujarat, where as low numbers of amphibians with 8 species were recorded at dry region of Kachchh.

Species Distribution : Distribution of each amphibian species in the state very interesting. *Ichthyophis bombayensis*, *Ramanella montana* and *Uperodon gloubulosus* are found to be restricted to South Gujarat, only. *Hoplobatrachus cressus* has been recorded from a small wetland of Lambha village, Ahmedabad only. Eight species of frogs and toads: *Duttaphrynus* (= *Bufo*) *melanostictus*, *B. stomaticus*, *Microhyla ornate*, *Euphlyctis cyanophlyctis*, *E. hexadactylus*, *Hoplobatrachus tigerinus*, *Fejervarya limnocharis* and *Sphaerotheca breviceps* are evenly distributed in the entire state.

Table 1*List of Protected Areas explored of Gujarat State during the study.*

Sl. No.	Protected Area	Area of PA (km ²)	Survey
Sanctuaries :			
1	Gir Wildlife Sanctuary	258.71	Surveyed
2	Nalsarovar Bird Wildlife Sanctuary	120.82	Not
3	Wild Ass Sanctuary	4953.70	Visited
4	Khijadia Bird Sanctuary	6.05	Surveyed
5	Jessore Bear Wildlife Sanctuary	180.66	Surveyed
6	Barda Wildlife Sanctuary	192.31	Surveyed
7	Hingolghadh Wildlife Sanctuary	6.54	Surveyed
8	Narayan Sarovar Wildlife Sanctuary	765.79	Surveyed
9	Ratanmahal Bear Wildlife Sanctuary	55.65	Surveyed
10	Shoolpaneshwar Wildlife Sanctuary	607.70	Visited
11	Marine Wildlife Sanctuary	295.03	Surveyed
12	Kachchh Desert Wildlife Sanctuary	7506.22	Surveyed
13	Porbandar Bird Wildlife Sanctuary	0.09	Visited
14	Gaga Bustard Wildlife Sanctuary	3.33	Visited
15	Rampara Wildlife Sanctuary	15.01	Surveyed
16	Thol Wildlife Sanctuary	6.99	Visited
17	Pania Wildlife Sanctuary	39.63	Not
18	Balaram-Anmbaji Wildlife Sanctuary	542.08	Visited
19	Jambughoda Wildlife Sanctuary	130.38	Surveyed
20	Purna Wildlife Sanctuary	160.84	Surveyed
21	Kachch Bustard Wildlife Sanctuary	2.03	Visited
22	Mitiyala Wildlife Sanctuary	18.22	Visited
Total of sanctuaries		16440.93	
National Parks :			
23	Gir National Park	258.71	Surveyed
24	Blackbuck National Park	34.08	Surveyed
25	Vansda National Park	23.99	Surveyed
26	Marine National Park	162.89	Surveyed
Total of National Parks		479.67	

Table*Numbers of amphibian species recorded and it*

Sl. No.	Scientific Name	South Gujarat		Central Gujarat			North Gujarat			
		Purna WS	Vansda NP	Shool-peneshwar WS	Jambu-ghoda WS	Ratan-mahal WS	Bala-ram A WS	Jassor WS	Thol Bird WS	Black-buck NP
1	<i>Ichthyophis bombayensis</i>	Uc	Uc	--	--	--	--	--	--	--
2	<i>Duttaphrynus (=Bufo) melanostictus</i>	Co	Co	Y	Co	Co	Y	Co	Y	Co
3	<i>B. stomaticus</i>	Co	Co	Y	Co	Co	Y	Co	Y	Co
4	<i>B. viridis</i>	--	--	--	--	--	Y	Uc	--	--
5	<i>Kaloula taprobanica</i>	R	R	Y	R	R	--	--	--	--
6	<i>Microhyla ornata</i>	Ab	Ab	Y	Uc	Uc	Y	Co	Y	Co
7	<i>Ramanella montana</i>	Uc	R	--	--	--	--	--	--	--
8	<i>Uperodon gloubulosus</i>	R	R	Y	--	--	--	--	--	--
9	<i>U. sytoma</i>	Uc	R	Y	Uc	Uc	Y	Uc	Y	--
10	<i>Polypedates maculatus</i>	Co	Co	Y	Co	R	Y	R?	--	--
11	<i>Euphlyctis cyanophlyctis</i>	Ab	Ab	Y	Ab	Ab	Y	Ab	Y	Co
12	<i>E. hexadactylus</i>	Co	Co	Y	Uc	--	Y	Co	Y	--
13	<i>Hoplobatrachus crassus</i>	--	--	--	--	--	--	--	--	--
14	<i>H. tigerinus</i>	Co	Co	Y	Co	Co	Y	Co	Y	Uc
15	<i>Indirana leithi</i>	R	--	--	--	--	--	--	--	--
16	<i>Ferjevaria keralensis</i>	Co	Co	Y	R	--	--	--	--	--
17	<i>F. limnotheris</i>	Ab	Ab	Y	Ab	Ab	Y	Co	Y	Co
18	<i>F. syhandrensis</i>	Uc	R	--	--	--	--	--	--	--
19	<i>Sphaerothera breviceps</i>	Co	Co	Y	Co	Co	Y	Co	Y	Uc
20	<i>S. rufescens</i>	R	R	--	--	--	--	--	--	--
Total		18	17	13	12	10	11	11	9	7

(Y= species present, Ab = Abundance, Co = Common, Uc = Uncommon, R = Rare, -- = not recorded)

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status at various protected areas of Gujarat State.

Saurashtra								Kachchh			
Gir S & NP	Miti- yala WS	Barda WS	Gaga BWS	Marine NP & S	Khija- diya WS	Ram- para WS	Hingol- gadhi WS	Wild Ass WS	Kachchh BWS	Nara- yan SWS	Kachchh DWS
--	--	--	--	--	--	--	--	--	--	--	--
Co	Y	Co	Y	Co	Co	Co	Co	Y	Y	Co	Co
Co	Y	Co	Y	Co	Co	Co	Co	Y	Y	Co	Co
--	--	--	Y	R	--	--	--	--	Y	R	--
--	--	--	--	--	--	--	--	--	--	--	--
Uc	Y	Uc	Y	Uc	Co	Co	Ab	Y	Y	Co	Ab
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
R?	--	R?	--	--	--	--	--	--	--	--	--
Ab	Y	Ab	Y	Co	Ab	Ab	Ab	Y	Y	Ab	Co
Co	Y	Co	--	--	Uc	Uc	Uc	Y	Y	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Co	Y	Co	Y	--	Co	Co	Co	Y	Y	Co	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
Ab	Y	Co	Y	Co	Co	Ab	Ab	Y	Y	Co	Co
--	--	--	--	--	--	--	--	--	--	--	--
Co	Y	Uc	Y	--	Co	Co	Y	Ab	Y	Co	--
--	--	--	--	--	--	--	--	--	--	--	--
9	8	9	8	6	8	8	8	8	8	8	5

Habits and Habitat : According to the evolutionary adaptation of each species, amphibians inhabit different habitat. Here

7 species of fossorial, 4 species of aquatic and 3 species of semi-aquatic frogs, 4 terrestrial species and 2 species of arboreal/tree dwelling forms of amphibians were recorded (Table 3).

Table 3

Systematic list of amphibian recorded from Gujarat State

Sl. No.	English name/ Scientific name	Habits	Status
ORDER : GYMNOPHINA			
Family : Ichthyophiidae			
1	Maharashtra caecilian (<i>Ichthyophis bombayensis</i>)	Fossorial	Less Common
ORDER: ANURA			
Family: Bufonidae			
2	Common Asian toad [<i>Duttaphrynus</i> (= <i>Bufo</i>) <i>melanostictus</i>]	Terrestrial	Abundant
3	Marbled toad (<i>Bufo stomaticus</i>)	Terrestrial	Abundant
4	Green toad (<i>Bufo viridis</i>)	Terrestrial	Common
Family: Microhylidae			
5	Painted bull-frog (<i>Kaloula taprobanic</i>)	Fossorial	Less Common
6	Ornate narrow-mouthed frog (<i>Microhyla ornata</i>)	Fossorial	Abundant
7	Jerdon's Ramanella (<i>Ramanella montana</i>)	Tree Dwelling	Less Common
8	Grey balloon frog (<i>Uperodon gloubulosus</i>)	Fossorial	Rare
9	Marbled balloon frog (<i>Uperodon sytoma</i>)	Fossorial	Common
Family: Rhacophoridae			
10	Indian tree frog (<i>Polypedates maculates</i>)	Arboreal	Common
Family: Ranidae			
11	Indian skipping frog (<i>Euphlyctis cyanophlyctis</i>)	Aquatic	Abundant
12	Indian green frog (<i>Euphlyctis hexadactylus</i>)	Aquatic	Less Common
13	Jerdon's bull frog (<i>Hoplobatrachus crassus</i>)	Aquatic	Rare
14	Indian bull frog (<i>Hoplobatrachus tigerinus</i>)	Aquatic	Common
15	Leith's frog (<i>Indirana leithi</i>)	Terrestrial	Rare
16	Kerala warty frog (<i>Ferjevarya keralensis</i>)	Semi-Aquatic	Less Common
17	Cricket frog (<i>Fejervarya limnocheris</i>)	Semi-Aquatic	Abundant
18	Syhadra frog (<i>Fejervarya syhandrensis</i>)	Semi-Aquatic	Less Common
19	Short-headed burrowing frog (<i>Sphaerotheca breviceps</i>)	Fossorial	Abundant
20	Rufescent burrowing frog (<i>Sphaerotheca rufescens</i>)	Fossorial	Rare

Fig. 2



One of the unidentified frogs (*Sphaerotheca* sp.) from Jambughoda Wildlife Sanctuary, Gujarat.

Uncertain Records : A literature survey shows that the state amphibian fauna contains 24 species including two species Gymnophina (leg-less) and 22 species of Anura (tail-less). But present study indicates only 20 species of amphibians inhabiting the state. This shows that four species of amphibians were recorded in the study. These four species of amphibians are Khandala caecilian (*Indotyphlus battersbyi*), Red narrow-mouthed frog (*Microhyla rubra*), Fungoid frog (*Hydrophylax malabarica*) and Bamboo tree frog (*Polypedates leucomystax*). These species of amphibians might have not been

recorded (in this survey) due to the following reasons and possibilities :

The Khandala caecilian (*Indotyphlus battersbyi*) was recorded from Okha, Jamnagar District and the specimen (AMNH 89788) was deposited in the American Museum of Natural History, New York, USA (Dutta, 1997). But the locality area of Okha is not suitable for caecilians (Daniel, 2002). The present Habitat Survey results of the areas show that there was no perennial fresh water body in the entire Okha Mandal areas. Therefore the

record of the species needs further confirmation.

Few literatures (Daniel and Shull, 1963; Dutta, 1997; Daniel, 2005) show the distribution range of Bamboo tree-frog (*Polypedates leucomystax*) in Dangs and Surat of South Gujarat. But according to Dr. Indraneil Das (pers. comm.) the species is only restricted to North and East India and further in East Asia. Hence records from Western and Central India require further confirmation.

The Fungoid frog (*Hydrophylax malabarica*) has been reported earlier from Navsari by Naik and Patel (1986). But during the present study, this species did not come across in any areas of South Gujarat. Which indicates that more extensive search is needed in the areas for establishing its presence in the state.

An environment impact assessment report of Shoolpaneshwar Wildlife Sanctuary (Sabnis and Amin, 1992) shows the presence of *Microhyla rubra*, *Rana*

brevipalmata (now *Fejervarya brevipalmata*), *Rana temporalis*, *Rana phrynoderma* (now *Indirana phrynoderma*), *Bufo microtympanum* and *Bufo fergusonii* (now *Bufo scaber*). But presence of these six species of frogs and toads is uncertain. Because output of the report researchers group by Naik and Vinod (1992, 1993a, b) and Naik *et al.* (1995) never claimed about records of the species from the sanctuary (except *Microhyla rubra*), which shows that record of those five species of frogs and toads been mistaken.

A few species of frogs and toad have included in this study, that are mentioned in a few publications; the species of *Fejervarya* sp. (Bhatt *et al.*, 1999) from Gir National Park and Barda Wildlife Sanctuary (Vyas, 2004), *Bufo* sp. from Narayan Sarovar Wildlife Sanctuary (Vyas, 2002) and *Sphaerotheca* sp. (Fig. 2) because these amphibian species are under study and are awaiting further confirmation and naming. But it indicates that the state amphibian fauna is rather larger than the present study.

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SUMMARY

Gujarat State is one of the dry states of India. Amphibian fauna of the state has 20 species belonging to 2 orders; 5 families and 13 genera including a species of Caecilian and 19 species of frogs and toads. In overview of amphibian species richness and diversity in sanctuaries and NPs of the state has been discussed in the present paper. Eight species of frogs and toads viz. *Duttaphrynus* (= *Bufo*) *melanostictus*, *B. stomaticus*, *Microhyla ornate*, *Euphlyctis cyanophlyctis*, *E. hexadactylus*, *Hoplobatrachus tigerinus*, *Fejervarya limnocharis* and *Sphaerotheca breviceps* are evenly distributed in the entire state. High diversity of amphibians

is recorded at Vansda National Park and Purna Wildlife Sanctuary of South Gujarat with 17 and 18 species respectively while low diversity was recorded at Kachchh Desert Wildlife Sanctuary and Narayan Sarovar Wildlife Sanctuary. Various aspects of state amphibian fauna still remain unaddressed which needs to be explored scientifically to assess the importance of amphibian fauna.

Key words : Amphibians, Gymnophina (Caecilian). Anura (frogs and toads), Gujarat State, Diversity, Richness.

गुजरात, भारत के उभयचरों की वर्तमान विविधता और सम्पन्नता की समीक्षा

राजू व्यास

सारांश

गुजरात राज्य भारतवर्ष के शुष्क राज्यों में आता है। इस राज्य में उभयचर जीवजन्तुओं की दो गणों में पड़ती बीस जातियां, मिलती हैं जो पांच वंशों और तेरह प्रजातियों में आती हैं, जिनमें सेसिलियन की एक तथा मेंढकों और भेकों की उन्नीस जातियां सम्मिलित हैं। इन उभयचर जातियों की सम्पन्नता और विविधता जो राज्य सीमाओं में पड़ते अभयारण्यों और राष्ट्रीय उपवनों में मिलती हैं प्रस्तुत अभिपत्र में विवेचित की गई है। मेंढकों और भेकों की आठ जातियां अर्थात् *दुताफ्राइनस* (= *ब्यूफो*) *मेलोनोस्टिक्टस*, *ब्यू* *स्टोमेटिकस*, *माइक्रोहायला ओनार्टे*, *यूलिक्टस*, *सायनोलिक्टस*, *यू* *हैक्सेडेक्टलस*, *होप्लोबाट्राकस टाइगेरिनस*, *फेजेरवार्या लिम्नोकैरिस* और *स्फीरोथेका ब्रीविसेप्स* पूरे राज्य में समानतः वितरित हैं। उभयचरों की अधिक विविधता गुजरात राज्य के बांसदा राष्ट्रीय उपवन और पूर्णा वन्यप्राणि अभयारण्य से आलेखित हुई हैं जहां इनकी क्रमशः 17 और 18 जातियां मिली हैं। कम विविधता कच्छ मरु वन्यप्राणि अभयारण्य और नारायण सरोवर वन्यप्राणि अभयारण्य में मिली। राज्य के उभयचर जीवों के अनेक पक्षों को समझना अभी बाकी है जिनकी वैज्ञानिक खोज कराने की आवश्यकता है ताकि उभयचर जीवों के महत्व का आकलन किया जा सके।

References

- Bhatt, K., R. Vyas and Mahesh Singh (1999). Herpetofauna of Gir protected area, *Zoos' Print J.*, **14** (5):27-30.
- Boulenger, G.A. (1890). *The fauna of British India, including Ceylon and Burma*. Reptilia and Batrachia. Taylor and Francis, xviii + 541 pp.
- Boulenger, G.A. (1920). *A monograph of the South Asia, Papuan, Malayesian and Australian frogs of the genus Rana*. Record of Indian Museum, Calcutta. 226 pp.
- Champion, H G. and S. K. Seth (1968). *A revised survey of the forest types of India*. Manager of Publications, GoI, Delhi. 404 pp.
- Chandra, K. and P.U. Gajbe (2005). An inventory of Herpetofauna of Madhya Pradesh and Chhattisgarh. *Zoos' Print J.*, **20** (3): 1812-1819.
- Daniel, J.C. (1963a). Field guide to the amphibians of Western India. Part I. *J. Bom. Nat. Hist. Soc.*, **60**(2): 415-438.
- Daniel, J.C. (1963b). Field guide to the amphibians of Western India. Part II. *J. Bom. Nat. Hist. Soc.*, **60**(3): 690 -702.
- Daniel, J.C. (1975). Field guide to the amphibians of Western India. Part III. *J. J. Bom. Nat. Hist. Soc.*, **72**(2): 506 - 522.
- Daniel, J.C. (2002). *The book of Indian Reptiles and Amphibians*. Bombay Natural History Society/ Oxford University Press, Mumbai. 238 pp.

- Daniel, J.C. and E.M. Shull (1963). A list of the reptiles and amphibians of the Surat Dangs, South Gujarat. *J. Bom. Nat. Hist. Soc.*, **60**(3): 737-743.
- Daniel, R.R.J. (1997). A field guide to the frogs and toads of the Western Ghats, India: Part I, II and III. *Cobra*, **27, 28 & 29** : 1-25, 1-24 and 1-13.
- Daniel, R.R.J. (2005). *Amphibians of Peninsular India*. Universities Press (India) P. Ltd., Hyderabad. 268pp.
- Dutta, S.K. 1997. *Amphibians of India and Sri Lanka* (Checklist and Bibliography). Odyssey Publishing House. 342 pp.
- Das, I. and S.K. Dutta (1998). Checklist of the Amphibians of India, with English common names. *Hamadryad*, **23** (1): 63-68.
- Naik, Y.M. and R.K. Patel (1986). Record of the fungoid frog *Rana malabarica* (Bibron) in Navsari (Gujarat State). *J. Bom. Nat. Hist. Soc.*, **83**: 672.
- Naik, Y.M. and K.R. Vinod (1992). Amphibia of Shoolpaneshwar Sanctuary. *Cobra*, **8**: 7-10.
- Naik, Y.M. and K.R. Vinod (1993a). Record of the verrucose frog *Rana keralensis* (Dubois) in Shoolpaneshwar Wildlife Sanctuary (Bharuch Dist., Gujarat). *J. Bom. Nat. Hist. Soc.*, **90**: 521-522.
- Naik, Y.M. and K.R. Vinod (1993b). The distribution of amphibians in Gujarat State, India. *Hamadryad*, **18**: 28-34.
- Naik, Y.M., K.R. Vinod and B. Pilo (1995). The importance of preservation of biodiversity of amphibians in Shoolpaneshwar Wildlife Sanctuary. *Proc. Nat. Symp. Recent Trends in Indian Wildlife Research*, held at A.V.C. College, Mayiladuthurai. pp. 38-40.
- Padhye, A.D. and H.V. Ghate (2002). An overview of amphibian fauna of Maharashtra State. *Zoos' Print J.*, **17**(3): 735-740.
- Sabnis, S.D. and J.V. Amin (1992). *Eco-environmental studies of Sardar Sarovar Environs*. M.S. University, Baroda. 388 pp.
- Sharma, S.K. (1995). An overview of the amphibian and reptilian fauna of Rajasthan. *Flora and Fauna*, **1**(1): 47-48.
- Vyas, R. (2002). Preliminary survey of herpetofauna of Narayan Sarovar Sanctuary, Gujarat. *Zoos' Print J.*, **17**(6): 812- 814.
- Vyas, R. (2004). Note on amphibians of Barda Wildlife Sanctuary, Gujarat. *Zoos' Print J.*, **19**(7): 1545.
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