RESEARCH ARTICLE

Diversity, Distribution and Status of the Amphibian fauna of Sangli district, Maharashtra, India

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ABSTRACT

30 species of amphibians were reported during a survey belonging to 19 genera of 9 families and 2 orders from Sangli district, Maharashtra, India, during June 2013 to May 2017. Out of 30 species recorded, 19 species are endemic to Western Ghats. All of the tehsils in this district except Shirala fall under semi arid zone having rich amphibian diversity. Shirala tehsil is flanked by Western Ghats with high rainfall and humidity harbouring highest number of species, while Atpadi tehsils is a drought prone zone with the lowest number of species. The highest numbers of species are reported at 1100m asl and the lowest number of species in the area below 600m asl. Along with checklist, information about the habitat, rainfall, temperature, distribution and status of amphibians in the district are given.

Keywords: Amphibian diversity, distribution, status, habitats, Sangli district

INTRODUCTION

The diversified topography, geographic location, high rainfall and humidity have likely to be supported to the survival of numerous species of amphibians in the Western Ghats and the Eastern Himalayas (Andrews *et al.,* 2005). Amphibian of India comprises of about 405 species (Dinesh *et al*., 2017), however the exact number of species has not been known since new species of a amphibians are being discovered. The amphibian fauna of British India was first published by Boulenger (1890). In India, several taxonomic revisions and new species have been described by Biju and Bossuyt (2009), Biju *et al.* (2014), Dahanukar *et al*. (2016), Garg and Biju (2017), Giri *et al.* (2004), Kuramoto *et al*. (2007) and Padhye *et al.* (2014, 2015 and 2017).

In the Maharashtra Yazdani and Mahabal (1976) have listed the 11species of amphibians from Pune. Ravichandran and Pillai (1990) have reported 13 species of amphibians from Maharashtra including 1 new species. Sekar (1999) has given a list of 34 species of amphibians with four new records

from Maharashtra. Kamble (2002) enlisted 11 species of amphibians from Ujani wetland, Solapur district. Jadhav *et al*. (2012) studied an amphibian fauna from Koyana, Patan Tehsil of northern Western Ghats, Maharashtra. Padhye *et al.* (2012) represented 53 species of amphibians from Maharashtra. Prasad *et al.* (2013) reported 37 species of amphibians from Satara tehsil.

Pande and Pathak (2005) reported 5 species of amphibians from the Chandoli National Park. Lawate and Mule (2009) published a checklist of herpatofauna of the Chandoli National Park, which contains16 species of amphibians. Jadhav *et al.,* (2009) reported *Gegeneophis peters* from Walwa, Dist-Sangli, Maharashtra. Kumbar and Patil (2010) have given checklist of 9 anuran species from Palus tehsil including Sagareshwar wildlife sanctuary in the Sangli district. Abdar (2014) has given a list of 4 species of amphibians of the Chandoli National Park. More (2015) reported 15 species of amphibians from Sangli district. However, most of the studies on amphibians in this district are limited to short surveys. Hence the present survey was undertaken to make an extensive and systematic study of the amphibian fauna of Sangli district with special reference to their diversity, distribution, habitat and status. This survey provides baseline data and scientific information for conservation of amphibians from arid zone.

MATERIAL AND METHODS

Sangli district, a part of the Deccan plateau lies between latitude $16^0$52' and $16^0$87' N and longitude $74^0$34' and $74^0$56' E in the Western part of Maharashtra. Sangli district is one of the largest drought prone districts in Maharashtra state of India with an area 8601.5 sq. Kms. It includes ten Tehsils *viz*. Shirala, Walwa, Palus, Kadegaon, Khanapur (Vita), Atpadi, Tasgaon, Miraj, Kavathe-Mahankal and Jath. Altitude of the district is 500 - 1100m asl. and average temperature is 30^0C. Climatically it falls under the rain shadow region of Sahyadri Mountain. The monsoon is worth four months of rainy season followed by eight months of dry period of winter and summer. The rainfall decreases from West (Sahyadri ranges) to the East. The Khanapur (Vita), Atpadi, Tasgaon, Miraj, Kavathe-Mahankal and Jath tehsils are drought prone zone (rainfall below 500 mm/year), Walwa, Palus, Kadegaon tehsils have a moderate rainfall zone (rainfall below 1000mm/year) and Shirala tehsil flanked by the Western Ghats on the western side with the heavy rainfall zone (rainfall above 3000 mm/year).

The present study has been carried out from June 2013 to May 2017. Field studies were mainly done by visits to all ten tehsils of Sangli district and to all the protected areas, during rainy and dry season both in day and night. At all locations, intensive search for amphibians was undertaken by visual encounters method; the standard method formulated for measuring and monitoring the amphibian diversity by IUCN/SSC- DAPTF (Crump, Heyer *et al*., 1994). Here all possible sites such as the river bank, near water bodies, along streams, in agricultural lands, grasslands, under leaf litter, on tree trunks, on foliages, under stones, logs, rock crevices and decaying vegetation were searched. The searching is made of frogs and toads using torch lights during night. On every amphibian sighting, information on species, habitats, microhabitat and altitude were recorded. All amphibians observed during the study were photographed and after taking morphometric measurements they are released back into their natural habitat, as per the standard methods for amphibians (Crump, Heyer *et al*., 1994). Specimen identification was made on the basis of morphometry, calls, available literature Boulenger (1890), Chanda (2002), Daniels (2005), Dutta (1997), Gururaja (2012), Inger & Dutta (1986), and with the help of other taxonomists. The nomenclatures of species were updated with the checklist by Dinesh *et al.* (2017) and Frost (2017).

RESULTS AND DISCUSSION

A total of 30 species of amphibians were recorded from various parts of Sangli district during the survey belonging to 19 genera of 9 families and 2 orders (Table 1). Considering number of species in each family Bufonids with 3 species, Dicroglossids 9 species, Microhylids 4 species, Nyctibatrachids 2 species, Ranids 3 species, Ranixalids 3 species, Rhacophorids 3 species and 3 species of Caecilians (Table 1). Of these 19 species recorded during the study are endemic to the Western Ghats. 30 species of amphibians of Sangli district fall under the various categories of the IUCN red list; endangered 2, critically endangered 1, vulnerable 3, least concerned 17, data deficient 1, near threatened 2 and 4 not assessed. 8 species were

Plate 1: Amphibian fauna of Sangli District

Plate 2: Amphibian fauna of Sangli District

Table 1. Checklist of amphibian fauna of Sangli district with distribution, status, endemism, IUCN status and WPA- cites.

Sr. No.	Name of Species	Common Names	Location of Species (Tehsils)	Status	Endemism	IUCN Red Lest	WPA-Cites
ORDER: ANURA (Fischer von Waldheim) **FAMILY: BUFONIDAE (Gray)**							
1	*Duttaphrynus melanostictus* (Schneider 1799)	Common Indian Toad (Common Asian Toad)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	
2	*Duttaphrynus stomaticus* (Lutken, 1862)	Marbled Toad (Indus Valley Toad)	3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	
3	*Xanthophryne koynayensis* (Soman, 1963)	Koyna Toad	1	Rare	EWG	EN	
FAMILY: DICROGLOSSIDAE (Anderson)							
4	*Euphlyctis cyanophlyctis* (Schneider, 1799)	Indian Skittering Frog (Indian Skipper Frog)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	Sch. IV APP.II
5	*Fejervarya caperata* (Kuramoto, Joshy, Kurabayashi and Sumida, 2007)	Canara Cricket Frog	1	Rare	EWG	Not Assessed	
6	*Fejervarya cepfi* (Garg and Biju, 2017)	CEPF Burrowing Frog	1	Rare	EWG	Not Assessed	
7	*Fejervarya keralensis* (Dubois, 1981)	Kerala Warty Frog (Verrucose Frog)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	EWG	LC	Sch. IV
8	*Fejervarya syhadrensis* (Annandale, 1919)	Bombay Wart Frog	1, 2, 3, 4, 5, 6, 7, 8	Abundant	NE	LC	
9	*Hoplobatrachus tigerinus* (Daudin, 1802)	Indian Bull Frog	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	Sch. IV App.II
10	*Sphaerotheca breviceps* (Schneider, 1799)	Indian Burrowing Frog	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	
11	*Sphaerotheca dobsonii* (Boulenger, 1882)	Dobson's Burrowing Frog	1,2	Rare	EWG	LC	
12	*Sphaerotheca pashchima* (Padhye, Dahanukar, Sulakhe, Dandekar, Limaye and Jamdade, 2017)	Western Burrowing Frog	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	Not Assessed	

Table 1: continued...

Sr. No.	Name of Species	Common Names	Location of Species (Tehsils)	Status	Endemism	IUCN Red Lest	WPA-Cites
FAMILY: MICROHYLIDAE (Gunther)							
13	*Microhyla ornata* (Dumeril and Bibron, 1841)	Ornate Narrow-mouthed Frog	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	
14	*Uperodon globulosus* (Gunther, 1864)	Grey Balloon Frog	1, 2, 3, 4, 8	Common	NE	LC	
15	*Uperodon mormorata* (Rao, 1937)	Marbled Ramanella	1, 2	Rare	EWG	EN	
16	*Uperodon systoma* (Schneider, 1799)	Marbled Balloon Frog	3, 4, 5, 6, 7, 8, 9, 10	Abundant	NE	LC	Sch. IV
FAMILY: NYCTIBATRACHIDAE (Blommers-Schlosser)							
17	*Nyctibatrachus humayuni* (Bhaduri and Kripalani, 1955)	Bombay Night Frog	1	Rare	EWG	VU	
18	*Nyctibatrachus petraeus* (Das and Kunte, 2005)	Castle Rock Night Frog	1	Rare	EWG	LC	
FAMILY: RANIDAE (Rafinesque)							
19	*Clinotarsus curtipes* (Jerdon, 1853)	Bicoloured Frog	1	Rare	EWG	NT	Sch. IV
20	*Hydrophylax* bahuvistara (padhye, Jadhav, Modak, Nameer and Dahanukar, 2015)	Fungoid Frog	1, 2	Rare	EWG	LC	Sch. IV
21	*Indosylvirana caesari* (Biju, Garg, Mohony, Wijayathilaka, Senevirathne and Meegaskumbura, 2014)	Bronzed Frog (Maharashtra Golden Backed Frog)	1	Rare	EWG	NT	Sch. IV
FAMILY: RANIXALIDAE (Dubois)							
22	*Indirana beddomii* (Gunther, 1875)	Beddome's Leaping Frog	1	Rare	EWG	LC	Sch. IV
23	*Indirana chiravasi* (Padhye, Modak and Dahanukar, 2014)	Amboli Leaping Frog	1	Rare	EWG	Not Assessed	
24	*Indirana leithii* (Boulenger, 1888)	Leith's Leaping Frog	1	Rare	EWG	VU	

Table 1: continued…

Sr. No.	Name of Species	Common Names	Location of Species (Tehsils)	Status	Endemism	IUCN Red Lest	WPA-Cites
FAMILY: RHACOPHORIDAE Hoffman							
25	*Polypedates maculatus* (Gray, 1834)	Common Indian Tree Frog (Chunam Frog)	1, 2, 3, 4, 8	Common	NE	LC	
26	*Pseudophilautus amboli* (Biju and Bossuyt, 2009)	Amboli Bush Frog	1	Rare	EWG	CE	
27	*Raorchestes bombayensis* (Annandale, 1919)	Bombay Bush Frog	1, 2, 3, 4, 8	Common	EWG	VU	
ORDER: GYMNOPHIONA (Muller) FAMILY: ICHTHYOPHIIDAE (Taylor)							
28	*Ichthyophis beddomei* (Peters, 1879)	Beddome's Caecilian	1	Rare	EWG	LC	
29	*Ichthyophis bombayensis* (Taylor, 1960)	Bombay Caecilian	1	Rare	EWG	LC	
FAMILY: INDOTYPHLIDAE (Lescure, Renous, and Gasc)							
30	*Indotyphlus maharashtraensis* (Giri, Gower and Wilkinson, 2004)	Maharashtra Caecilian	1	Rare	EWG	DD	

1-Shirala, 2-Walwa, 3-Palus, 4-Kadegaon, 5-Khanapur, 6-Atpadi, 7-Tasgaon, 8-Miraj, 9-Kavathe-Mahankal , 10-Jath
Rare- species found in 1-2 tehsils, Common- species found in 3-6 tehsils and Abundant- species found in more than 6 tehsils
EWR-Endemic to Western Ghats, NE- Non Endemic
EN- Endangered, CE- Critically Endangered, VU- Vulnerable, LC- Least Concerned, DD-Data Deficient, NT- Near Threatened.
Schedules IV- Indian Wildlife (protection) Act
App. II of CITES - The Conservation on International Trade in Endangered Species of Wild Flora and Fauna.

Table 2. Amphibian fauna of Sangli district with habitat, microhabitat, altitude range, annual temprature and annual rainfall

Sr. No.	Name of Species	Habitat	Microhabitat	Altitude (m)		Mean Annual Temp. (ºC)		Annual Rainfall (mm)	
				Min	Max	Min	Max	Min	Max
1	*D. melanostictus*	Terrestrial, near human habitats	On bare land, under stone, in crevices, under street lamps, near water bodies, agriculture land	500	1100	17	40	500	3000
2	*D. stomaticus*	Terrestrial, near human habitats	On bare land, under stone, near water bodies agriculture land, grass land	500	1100	25	35	500	2000
3	*X. koynayensis*	Terrestrial, On lateritic rock	On plateau, Under rock, in crevices, in grasses surrounded by forest	900	1200	18	26	1500	3000
4	*E. cyanophlyctis*	Aquatic, littoral	Found in almost all kinds of fresh water bodies	500	1100	17	38	500	3000
5	*F. caperata*	Semi aquatic	Wet soil, in grasses near water bodies, paddy and sugar cane field, on forest floor	600	800	20	24	1000	1500
6	*F. cepfi*	Semi aquatic, burrowing frog	Wet soil, on forest floor, forest edge, in grasses near water bodies, paddy and sugar cane field	650	1100	17	27	1500	3000
7	*F. keralensis*	Semi aquatic	Wet soil, in grasses near water bodies, paddy and sugar cane field, in swamp area, in villages	500	1000	17	38	500	3000
8	*F. syhadrensis*	Semi aquatic, near human habitation	Wet soil, in grasses near water bodies, paddy and sugar cane field, in swamp area, in villages	500	1000	20	30	500	2000
9	*H. tigerinus*	Semi aquatic, near human habitation	Agricultural fields, in ponds, lakes, wells and on forest floor	500	1100	17	40	500	3000
10	*S.breviceps*	Terrestrial, near human habitation	Moist soil, near water bodies, in agricultural land, on bare ground. Burrowing species	500	1000	17	40	500	2000
11	*S. dobsonii*	Terrestrial, burrowing frog	In leaf litter, on forest flour, moist soil close to water bodies, in paddy field, forest edge habitat	500	1050	22	27	1000	3000
12	*S. pashchima*	Terrestrial, near human habitation	Moist soil, near water bodies, in agricultural land, on bare ground. Burrowing species	500	1000	17	40	500	2000
13	*M. ornata*	Semi aquatic, near human habitation	In grasses, in and near water bodies, under stones, in crevices, on bare ground	500	1050	18	38	500	2500
14	*U. globulosus*	Terrestrial, burrowing frog	Termite Mountain, On bare ground, near water bodies, agriculture land	650	1000	22	30	1000	2500
15	*U. mormorata*	Terrestrial, burrowing frog	On wet soil, leaf litter, in paddy and sugar cane field, in forest	660	1000	22	24	1000	3000

Table 2. Continued…

Sr. No.	Name of Species	Habitat	Microhabitat	Altitude (m)		Mean Annual Temp. (ºC)		Annual Rainfal (mm)	
				Min	Max	Min	Max	Min	Max
16	*U. systoma*	Terrestrial, , near human habitation, burrowing frog	Termite Mountain, On bare ground, near water bodies, agriculture land	500	634	17	38	500	1000
17	*N. humayuni*	Aquatic, forest dwelling	Near shallow water streams, in rock crevices, in perennial stream, on leaves over hanging on running water	560	1100	21	25	2000	3000
18	*N. petraeus*	Aquatic, forest dwelling	In shallow water streams, in rock crevices, in perennial stream, on leaves over hanging on runing water, under stones	562	600	25	25	2000	3000
19	*C. curtipes*	Semi aquatic, forest dwelling	Forest floor, leaf litter, found near water bodies, slow running streams	630	1100	17	27	1000	3000
20	*H. bahuvistara*	Semi aquatic	found near water bodies, forest floor, leaf litter, in paddy and sugar cane field	600	1000	20	30	1000	2000
21	*I. caesari*	Semi aquatic,	Found near water bodies, forest floor, leaf litter, slow flowing streams	630	1100	17	25	1000	3000
22	*I. beddomii*	Terrestrial	On moist rock, on forest floor, leaf litter, in grasses near water bodies	550	1200	17	28	1000	3000
23	*I. chiravasi*	Terrestrial	On tree trunk, on moist rock, on forest floor, leaf litter, on moist soil, on wet clifts	500	1000	24	25	1000	3000
24	*I. leithii*	Terrestrial	On tree trunk, on wet rock, on forest floor, leaf litter, in grasses, on moist soil	590	1000	22	26	1500	3000
25	*P. maculatus*	Arboreal	On herbs, shrubs, trees, on sugarcane plantation	500	1100	20	30	500	1500
26	*P. amboli*	Arboreal	On herbs, shrubs, trees in forest	500	1000	24	25	1000	3000
27	*R. bombayensis*	Arboreal	On herbs, shrubs, trees, on sugar cane plantation and on ground	500	1300	18	25	1000	3000
28	*I. beddomei*	Fossorial	In moist loose soil, in forest, in marshes, cultivated land, in leaflitter	1000	1200	14	27	1000	3000
29	*I. bombayensis*	Fossorial	In humus rich soil, in leaf litter in forest, cultivated land, under rocks, in marshes	800	1550	19	27	1500	3000
30	*I. maharashtraensis*	Fossorial	Under moist soil: in forest, under rocks, on plateau	630	1000	25	25	2000	3000

included in the schedules IV of Indian Wildlife (protection) act and two species come under Appendix II of CITES. The highest number of amphibian species was recorded from Shirala tehsil (28 species), while the lowest number of species was observed in Atpadi tehsil (8 species). Status of amphibians shows that 10 species are abundant, 3 are common and 17 species are rare in the study area.

Duttaphrynus stomaticus, Fejervarya caperata, *Fejervarya cepfi* (Garg and Biju 2017), *Sphaerotheca pashchima* (Padhye *et al*. 2017), *Uperodon mormorata, Uperodon systoma, Pseudophilautus amboli* and *Ichthyophis bombayensis* are first reports from the study area. We found *Ichthyophis bombayensis* road killed specimen in Shirala tehsil.

CONCLUSION

Survey of amphibians in Sangli district concludes that the non endemic frogs *viz. Duttaphrynus melanostictus, Duttaphrynus stomaticus, Euphlyctis cyanophlyctis, Fejervarya keralensis*, *Fejervarya syhadrensis, Hoplobatrachus tigerinus, Sphaerotheca breviceps, Sphaerotheca dobsonii, Sphaerotheca pashchima Microhyla ornata, Uperodon systoma and Polypedates maculates* are widely distributed, well adapted and occur in all microhabitats while species which are endemic to Western Ghats shows diversity in habitat type. The highest number of species are found at altitude 1100m, where rainfall is high (1000-3000mm) and temperature is low (17-30^{0}C). Lowest numbers of species were recorded at altitude 600m where rainfall is low (below 600mm) and temperature is high (35-40^{0}C). (Table 2) Some species overlapping in their altitude range. Species were recorded from all the altitudes indicating their diverse adaptation to live in the low and high altitudes (Andrews et al., 2005) Environmental conditions and habitat of species play an important role in the distribution and diversity of species. Hence this survey provides baseline data and scientific information for conservation of amphibians from arid zone.

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