

AN OVERVIEW OF AMPHIBIAN FAUNA OF PUNE DISTRICT WITH SPECIAL REFERENCE TO THEIR STATUS IN AND AROUND PUNE CITY

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Abstract

For the last 30 years, Pune has been a center of industrialization and concomitant urbanization. As a result the city is rapidly growing, in size as well as in population, at the cost of its environment. This has severely impacted the flora and fauna of the city and its outskirts. We have been studying the impact of urbanization on amphibians for the last few years. Our studies reveal that there has been a loss of one-third of amphibian species from the city area in the last 25 years, mainly due to habitat destruction. The situation is similar in other townships throughout Pune District.

Keywords

Amphibia, status, Pune City, Pune District, urbanisation

Introduction

Pune District (17°54'-19°21'N and 73°18'-75°13'E) has the Western Ghats on its western border and thus the western half of the District lies in the rain shadow of Sahyadri Mountains. A very narrow strip on western border of Pune District forms the crest line of the Western Ghats. This strip shows heavy rainfall. There are many small and big dams in this narrow strip. The altitude ranges from 600m to 1200m. This part of the district contains lakes, perennial streams, rain forests, grass lands, hill slopes and paddy fields. The high diversity of habitats is responsible for the amphibian diversity in this part of the district.

The eastern half of the district shows very scanty rainfall. The altitude ranges between 300m to 400m. There are more semiarid planes and scrubs, some of which were used for urbanization and industrialization in last few years. The amphibian diversity of this part probably is not as rich as that of the western part, however more surveys are essential.

Pune City (18°31'N and 73°51'E), one of the most urbanized areas in Maharashtra state, is situated on Deccan Plateau almost on its western margin and lies on the leeward side of the Western Ghats. The narrow strip of moderate rainfall, in which the city is located, is known as rain shadow of Sahyadri - Western Ghats. It is the middle part of the district. The altitude ranges between 400m to 600m. It shows hill-ranges and scattered peaks having higher altitudes (up to 1400m). Rainfall is spread over five months from June to October with a peak during July. This part of the district shows higher amphibian diversity as it has both semitropical as well as semiarid areas.

The city is situated in the basin of the River Bhima. Two main rivers, Mula and Mutha, run through the City and finally meet River Bhima jointly (Sawant, 1972). It is 54km from the crest line of Sahyadri and around 110km from the sea. It is located in tropics with monsoon - rainy summer and dry winter. The climate is moderate throughout the year in and around Pune (between 15°C to 30°C with minimum temperature being 4°C in December-January and maximum temperature around 40°C in April- May). Average rainfall is around 715mm per year because Pune lies in rain shadow of Sahyadri. Various hills and hillocks surround the main parts of the city. Some hills were used for afforestation programs by the forest department, private housing societies and some NGOs. These hills and many other areas, especially on the outskirts of the city, are still green with vegetation. This plantation is of species like *Gliricidia*, Australian Acacia, Eucalyptus and some other exotic trees, along with some native vegetation that includes dry and moist deciduous as well as some evergreen species.

There is a fear of amphibian declines around the world; in fact severe declines in populations of amphibia have been noted in many parts of the world (Cooke & Ferguson, 1976; Gupta, 1998; Houlahan *et al.*, 2000). In some cases amphibian declines have been observed in areas totally free from any human interference (Lips, 1998; Matton 2000).

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Figure 1. Amphibian sampling sites in Pune District

In the last few years, urbanization and industrialization have been major threats causing habitat destruction on a very large scale. This has ultimately resulted in amphibian population declines in the affected areas of Pune District. A survey was conducted since June 1997 in the entire western part of Pune District and a few places in the eastern part of the district (Fig. 1) to determine if declines have taken place.

As a result of our survey, we have prepared checklists of amphibians both for Pune District as well as Pune City. It is based on personal field observations; study of specimens collected by different field workers and previously published records.

Methodology

All possible places where amphibians were known to occur in and around Pune City were surveyed. These sites were selected on the basis of previous published literature (Paranjape & Mulherkar, 1979). These surveys were carried out during the rainy season (late May to late October) of the year 2000 and the presence of various species of frogs was noted either on the basis of actual sighting, presence of egg clutches (for some species) or their calls. A site-wise distribution table was prepared for Pune City (Table 1). Various places in Pune District (randomly selected, mainly in Western Ghats) were also visited during the last three years (Fig. 1).

For those species whose identification in the field was difficult, the specimens were collected and identified in the lab with the help of available identification keys (Boulenger, 1890, 1920; Daniel

1963a,b, 1975; Daniel & Sekar, 1989), and were released back into their habitat. However some representative specimens were fixed in buffered formalin, preserved in 5% glycerol in rectified spirit and then sent to experts for identification or confirmation.

During these visits various other ecological factors like abundance and threat factors such as human interference (cloth washing, vehicle washing, construction activities, garbage dumping, etc.) and pollution, were also noted. Abundance was noted on visual or auditory basis only and no quantitative studies were done.

Observations and Discussion

Status of amphibians in Pune District

As per the checklist presented in this paper (Table 2), the amphibian fauna of Pune District comprises of 31 species out of 43 species known from the State (Padhye & Ghate, 2002) (Fig. 2).

Yazdani and Mahabal (1976) reported 11 different species of amphibians from Pune District (mainly Pune City and surrounding areas). Out of these 11, only eight were actually found in Pune City limits (as per unpublished locality records of WRS-ZSI Pune). With an addition of *Philautus bombayensis* (Paranjape & Mulherkar, 1979), the list was updated to 12 species from Pune District (9 from Pune City). Their survey was also restricted to Pune City and its outskirts. Ghate and Padhye (1996) further updated the list to 16 species from Pune District (10 from Pune City), by adding *Tomopterna sp.* (Kothrud, Pune), *Nyctibatrachus humayuni* (Bhimashankar), *Polypedates maculatus* (Lonavla) and *Rana malabarica* (Pirangut and Bhimashankar). The species *Rana limnocharis var. syhadrensis*, reported by Paranjape and Mulherkar, (1979) is now treated as a distinct species. Therefore according to all these previous records the tally of species from Pune District goes to 17 and that from Pune City goes to 11. *Tomopterna sp.*, which was an addition to Pune City list (Ghate & Padhye, 1996), was thought to be *rolandii*. However, later it was found to be a variation of *T. breviceps* (now *Sphaerotheca breviceps*), thus keeping the city species tally to 10 and district tally to 16. However, the number of species that were found in and around Pune City remains 13.

Habitat destruction in Pune District has deprived various amphibians of their feeding, breeding and hiding places. For example, a new industrial estate was established in Pirangut, an area near the City, where *Rana malabarica* as well as *Sphaerotheca sp.* were very commonly found earlier. Loss of paddy fields, which constitute a major breeding ground for *Rana malabarica*, has wiped out almost entire populations from the area. Construction of a new ring road, a by-pass and an express highway on the outskirts of the City has caused large-scale amphibian habitat destruction. These new highways constructed to reduce traffic congestion in the City pass through remaining

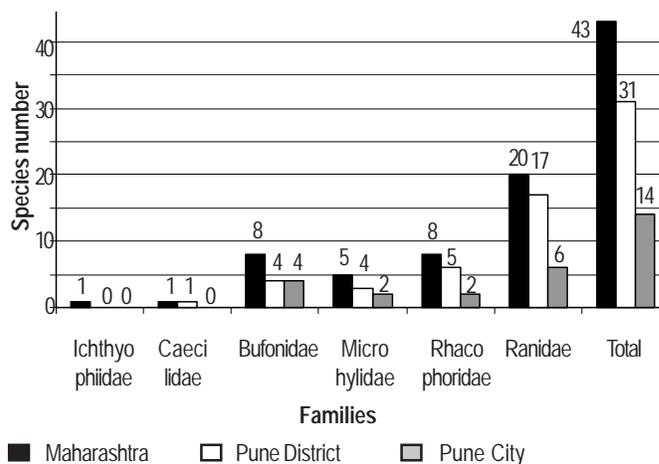


Figure 2. Family-wise distribution of amphibians.

forest areas, paddy fields and grasslands. Habitat quality surrounding these altered areas and roads is degraded due to drastic modification of soil and leveling or filling up of rainwater pools. At some places new highways constructed to enhance the road network pass through the sacred groves, destroying valuable forests. All these changes have drastically affected the amphibian populations and diversity. A sports-city establishment at Balewadi has also caused habitat destruction on a large-scale. Situations are similar in other townships in the entire District.

Status of amphibians in Pune City

Locality-wise distribution as well as the population status of amphibian species in and around Pune City is given in Table 1, and, Table 2 lists the species in Pune District and City.

Surveying the old city limits now suggests that 9 of the 13 species are not found in the localities mentioned by earlier

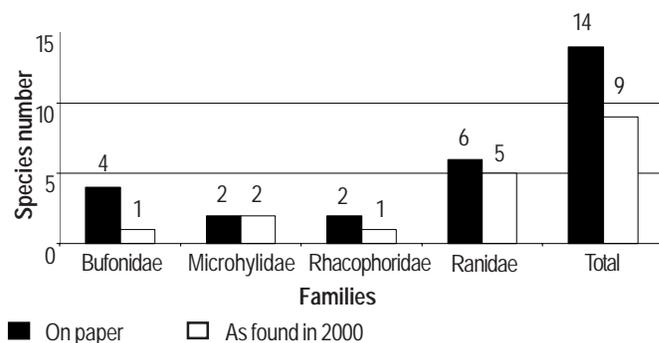


Figure 3. Comparative status of amphibians in Pune City.

Table 1. Species encounter record of amphibians during the year 2000 in various localities in and around current Pune City limits.

Family	Species	Status in various localities																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Bufonidae	<i>Bufo melanostictus</i>	C	VC															
	<i>Bufo stomaticus</i>	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	<i>Bufo parietalis</i>	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Microhylidae	<i>Bufo microtypanum</i>	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	<i>Microhyla ornata</i>	N	C	C	VC	VC	C	O	C	C	VC	VC	C	VC	C	VC	C	VC
Ranidae	<i>Uperodon globulosus</i>	N	N	N	R	O	N	N	N	N	N	N	N	N	N	N	N	N
	<i>Euphlyctis cyanophlyctis</i>	C	VC	O	VC	VC	C	VC	VC	VC	VC	VC	VC	C	VC	VC	VC	VC
	<i>Euphlyctis hexadactylus</i>	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	<i>Hoplobatrachus tigerinus</i>	O	C	O	C	VC	C	O	C	VC	VC	VC	O	C	C	C	VC	VC
	<i>Limnonectes limnocharis</i>	N	C	O	C	VC	C	O	N	C	C	C	O	N	O	C	C	VC
	<i>Limnonectes syhadrensis</i> [#]	C	VC	C	VC	VC	C	C	C	VC	VC	VC	VC	C	VC	VC	VC	VC
	<i>Sphaerotheca breviceps</i>	N	VC	C	C	VC	O	N	O	C	C	VC	VC	N	VC	C	VC	VC
Rhacophoridae	<i>Phyllautus bombayensis</i>	N	N	N	N	N	N	N	N	N	VC	N	N	N	N	N	N	N
	<i>Polypedates maculatus</i> [*]	N	N	N	N	R	N	N	N	O	N	N	N	N	N	N	N	N

1 - Old City; 2 - Parvati/Taljai; 3 - Koithrud; 4 - Pashan; 5 - Balewadi; 6 - University; 7 - Aundh; 8 - Katraj Lower; 9 - Khadakwasia; 10 - Sinhagad; 11 - Bhugaon; 12 - Alandi Road; 13 - Kawdi; 14 - Mastani Lake; 15 - Katraj Upper; 16 - Narhe-Ambegaon

[#] New record; ^{*} cited as *Rana limnocharis* var. *syhadrensis* by Paranjape and Mulherkar (1979).

X - Places outside the current urban limits; VC - Very common; C - Commonly seen; O - Occasionally observed; R - Rarely seen; N - Not observed during our survey

workers (Yazdani & Mahabal, 1976) (see Table 1). Our current survey suggests that five of the 13 species are not found even in the extended city, which has included the peripheral villages since 1976. The missing species are: *Bufo stomaticus*, *B. parietalis*, *B. microtypanum*, *Euphyllctis hexadactylus* and *Philautus bombayensis*. However, during this survey, an additional species (*Polypedates maculatus*) was observed from the extended city area (now making the city total 14). This additional species, presently found in the newer area as under the current city limits, suggests that it could have gone locally extinct within the Pune City limits before Yazdani and Mahabal's (1976) work. This species must be monitored in future for a better understanding of human influences on local extinctions.

There is thus a loss of around 33% of amphibian species from these areas (Fig. 3) during the last 25 years (i.e. since Yazdani & Mahabal, 1976). These species may be found elsewhere within Pune District. The loss is chiefly due to habitat destruction and deforestation, as the species lost are inhabitants of (a) perennial waterbodies, (b) paddy fields, (c) semiarid wasteland areas, and, (d) forests. Other factors like road kills or diseases may not have contributed to this loss, although no systematic work is done on the latter.

Some species show a great adaptability to urbanization and other changes in their natural habitats, *Bufo melanostictus* being an ideal example (observed feeding on insects under streetlights). They were found to feed on cockroaches and use garden tanks or lotus ponds for breeding. Due to this ability, *B. melanostictus* is very commonly observed even in the heart of Pune City. Along with *B. melanostictus*, *Euphyllctis cyanophlyctis* and *Limnonectes syhadrensis* also seem to have adapted to changes in their natural habitats (they were found to be common at most localities during our survey (see Table 1)). This kind of adaptability is probably not present among the species, which are now rare or absent. It appears that a few species like *Uperodon globulosus*, *Polypedates maculatus* and *Philautus bombayensis* are very sensitive to changes occurring due to urbanisation and industrialization. Due to various threats these species are on the verge of local extinction.

During the past 50 years, Pune has been the centre of industrialization. In fact, it is the second largest industrialized City of Maharashtra State. Concomitant with industrialization, there has been a rapid growth in population in and around Pune City. The net result is urbanization at the cost of deforestation on a large scale. Even the hills and hillocks around the City are now occupied by slum dwellers or private housing societies, and are being excavated for constructing tall buildings.

This growth of the City has been especially rapid since 1970. One of the authors, H.V.G., has been collecting amphibian eggs for various experiments as well as for the study of natural history,

since about 1973. The various areas from where eggs were regularly observed were: Pashan, Kirkee, University campus, Vitthalwadi and many other areas along the banks of Mutha River right up to Khadakwasla Dam, Hingne, Kothrud, Hadapsar, Yerawda, Pune - Nagar Road and adjacent areas. Steadily over a period of about 25 years, we have observed habitat destruction within these areas. Over 70% of the area, which was once available as habitat for amphibians, is now occupied either by industries, housing societies or slums. There has been wanton destruction of the vegetation covering the areas adjacent to the industries and slums. Moreover, with the City limits getting extended day by day conversion of farms, grasslands, paddy fields and other rural landscapes to human habitations, highways, industrial areas, etc. are a common feature.

In a previous paper we have already highlighted the effects of urbanization on amphibian species in and around Pune (Ghate & Padhye, 1996). Before that Paranjape and Mulherkar (1979) had also stated that the populations of certain frogs were disappearing due to habitat destruction. Places like Warje, Kothrud, Hingne, Dhayri, Parvati foot hills, Dhankawdi, Katraj, Kondhwa, Nagar Road, Alandi Road, Pashan, etc., in and around Pune City, were once haven for anurans. These now hold only small fragmented populations. Any major calamity, like scanty or irregular rainfall, can totally wipe out such fragmented populations. Construction of low level roads along the sides of riverbed has destroyed breeding sites on a large scale. Recently (while the finalization of this manuscript was in progress), the Municipal Corporation started filling up nullahs and old canals flowing through the City by placing pipelines to drain water; also a road has been constructed on a canal. This will effectively eliminate the last habitats and breeding sites left for frogs in the City.

Habitat destruction due to pollution of breeding ponds is another threat to amphibian population in the cities. Many streams, nullahs, water-filled stone quarries and rivers are polluted with domestic and industrial wastes and the problems due to pollution are discussed in detail in our earlier paper (Ghate & Padhye, 1996).

The situation appears to be the same for all major townships and cities, in the State where industrial and urban centers are being established. Want of hard data on development activities resulting in amphibian declines has created a problem regarding their conservation (Daniels, 1991). Similar situations however exist in other parts of India -- habitat destruction in the Western Ghats (Daniels, 1991), and destruction of habitat of Himalayan Newt *Tylotriton verrucosus* in the northern states (Shreshtha, 1989) being only two of the innumerable examples.

Moreover, introduction of exotic fishes like *Gambusia affinis* and Tilapia (*Oreochromis mossambicus*) in stone quarries,

Table 2. Checklist of amphibia of Pune District and City (compiled data).

Gymnophiona		19) <i>Limnonectes limnocharis</i> [<i>Rana limnocharis</i> Gravenhorst] ^{PC}
Caeciliidae		20) <i>Limnonectes nilagirica</i> [<i>Rana nilagirica</i> Jerdon] * Tamhini-Mulshi
1) <i>Indotyphlus battersbyi</i> Taylor ¹	Lonavla	21) <i>Limnonectes rufescens</i> [<i>Tomopterna rufescens</i> (Jerdon)] Tamhini-Mulshi
Anura		22) <i>Limnonectes syhadrensis</i> [<i>Rana syhadrensis</i> Annandale] ^{PC} ®
Bufoidea		23) <i>Rana malabarica</i> Tschudi
2) <i>Bufo melanostictus</i> Schneider ^{PC}		24) <i>Sphaerotheca dobsonii</i> [<i>Tomopterna dobsonii</i> (Boulenger)] * Tamhini-Mulshi & Lonavla
3) <i>Bufo microtypanum</i> Boulenger ^{1 PC}	Vetal Tekadi & Bhosari	25) <i>Sphaerotheca breviceps</i> [<i>Tomopterna breviceps</i> (Schneider)] ^{PC} Kothrud, Parvati, Alandi & Tamhini-Mulshi
4) <i>Bufo parietalis</i> Boulenger ^{1 PC}	Katraj & Wagholi	Rhacophoridae
5) <i>Bufo stomaticus</i> Lutken ^{PC}	Ferguson College, Pune University & Chakan	26) <i>Philautus bombayensis</i> (Annandale) ^{PC} Parvati, Vitthalwadi, Sinhagad, Lonavla & Tamhini-Mulshi
Microhylidae		27) <i>Philautus leucorhinus</i> (Lichtenstein and Martens) Tamhini-Mulshi
6) <i>Microhyla ornata</i> (Duméril & Bibron) ^{PC}		28) <i>Philautus</i> sp. (Closer to <i>glandulosus</i>) Tamhini-Mulshi
7) <i>Ramanella montana</i> (Jerdon)	Tamhini-Mulshi	29) <i>Philautus</i> sp. (Closer to <i>bombayensis</i>) Tamhini-Mulshi
8) <i>Uperodon globulosus</i> (Günther) ^{PC} §	Pashan & Jambhe	30) <i>Polypedates maculatus</i> (Gray) ^{PC} + Balewadi, Lonavla, Bhimashankar & Tamhini-Mulshi
Ranidae		31) <i>Polypedates</i> sp. (different from <i>maculatus</i>) Tamhini-Mulshi
9) <i>Euphlyctis cyanophlyctis</i> [<i>Rana cyanophlyctis</i> Schneider] ^{PC}		
10) <i>Euphlyctis hexadactylus</i> [<i>Rana hexadactyla</i> Lesson] ^{1 PC}	Khed	
11) <i>Hoplobatrachus crassus</i> [<i>Rana crassa</i> Jerdon] ^{**?}	Tamhini-Mulshi	
12) <i>Hoplobatrachus tigerinus</i> [<i>Rana tigerina</i> Daudin] ^{PC}		
13) <i>Indirana beddomei</i> [<i>Rana beddomei</i> (Günther)]	Tamhini-Mulshi, Lonavla & Bhimashankar	
14) <i>Indirana leitheii</i> [<i>Rana leitheii</i> Boulenger]	Sinhagad, Rajgad & Bhimashankar	
15) <i>Indirana phrynoderma</i> [<i>Rana phrynoderma</i> Boulenger] * Tamhini-Mulshi		
16) <i>Nyctibatrachus humayuni</i> Bhaduri and Kripalani	Lonavla & Bhimashankar	
17) <i>Nyctibatrachus major</i> Boulenger *	Dongarwadi-Mulshi & Lonavla	
18) <i>Limnonectes keralensis</i> [<i>Rana keralensis</i> Dubois] *	Tamhini-Mulshi	

¹ Authors have not observed these species at any locality within Pune District.

* Species reported for the first time from Pune District

** Species reported for the first time from Pune District but their identification is yet to be confirmed.

Scientific names according to Das and Dutta (1998), and Vences *et al.* (2000). Old names are given in square brackets.

^{PC} Species occurring in Pune City.

§ Tadpoles of *Uperodon globulosus* were collected from a single locality. However the adults could not be located within current City limits.

® cited as *Rana limnocharis* var. *syhadrensis* by Paranjape and Mulherkar (1979).

+ Recent addition to the species list from Pune

nullahs, as well as rivers have resulted in declines in amphibian population (Ghate & Padhye, 1996). *Gambusia affinis*, we have observed, consumes tadpoles as well as eggs of *Microhyla ornata*. In such places microhylids have suffered the most while ranids and bufonids continue to breed. This is the case of two water bodies within the Pune University campus (Ghate & Padhye, 1988). *Gambusia* and *Tilapia* have been introduced in rivers Mula and Mutha. Since the shallow pools and ditches in the riverbed support a good population of *Hoplobatrachus tigerinus*, *Euphlyctis cyanophlyctis* as well as *Limnonectes syhadrensis*, it is necessary to study the long-term effects of this introduction as well. Knowing the voracious feeding habits of *Tilapia*, it is likely to affect amphibian breeding in the future. Dasgupta (1990) reported that introduction of carps and other

fishes is a threat to survival of the Himalayan Newt *Tylotriton verrucosus*.

On the flip side, in the last few years, some hills around Pune City have become green again. This is due to efforts of the forest department, some private housing societies, some temple trusts as well as some non-government organizations. Military-occupied hills and scrublands still maintain their near natural status despite human pressures. However, special efforts are essential to re-establish lost amphibian species in these areas.

A definite plan to re-introduce lost species, protection and provision of habitats and breeding sites free from human interference must be evolved to protect amphibians of Pune

City. In this regard, concerned NGOs or the forest department should take the lead to construct breeding ponds, remove introduced invasives as well as establish an amphibian park similar to a snake park. Such a step will also help in raising public awareness among the city dwellers.

Special International Committees and Task Forces have been established in different parts of the world to understand the reasons for declining amphibian populations. Special measures to conserve amphibians have been initiated all over the world [see *Frog Log*, Newsletter of Declining Amphibian Population Task Force (DAPTF) being published quarterly for last 8 years and references therein]. Efforts are being made in India as well (Molur & Walker, 1998) and we hope that the situation will improve.

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