A PRELIMINARY REPORT ON THE VERTEBRATE DIVERSITY OF THE KALIVELI WATERSHED REGION

Mario Eric Ramanujam [1] and R. Anbarasan [2]

[1,2] Pitchandikulam Bioresource Centre, Auroville, Pondicherry 605101, India
Email: [1] tdef@auroville.org.in, ericramanujam@yahoo.co.in; [2] anbarasan_ecol@yahoo.com

plus web supplement of 4 pages

Abstract

Three-and-a-half years of (mainly passive) observations disclosed the fact that the Kaliveli watershed area is inhabited by at least 268 species of vertebrates. The greatest majority were birds (55.11%). They were followed by fish (18.28%), mammals (14.17%), reptiles (13.8%) and amphibians (2.61%). The conservation value of only 105 species could be determined - 1 Endangered, 12 Vulnerable, 55 Near Threatened and 37 of Least Concern. The only exotic was *Oreochromis mossambica*, an alien invasive species.

Kaliveli has been described as one of the two most important wetlands along the southeastern seaboard of India (Perennou, 1987; Perennou & Santharam, 1990). Being a birding hotspot, the avifauna has received much attention (Balachandran, 1994; Gopinath & Srinivas, 2004; Prennou, 1987, 1989, 1990; Perennou & Santharam, 1990; Pieter, 1987). A preliminary survey of the ichthyofauna of the floodplain and creek (but not the estuary) was undertaken and results reported (Ramanujam, 2005). In addition to avifaunal diversity gleaned from other sources, vertebrate diversity of the wetland and the region in its immediate vicinity has been listed (Sharma, 1997; Gopinath & Srinivas, 2004), but these were brief notes of casual observations.

The Auroville forest plantations have received some attention so far as birds and snakes are concerned. Both commissioned and non-commissioned reports of these exercises exist (Anne, 1996; Balachandran & Rajan, 1997; Bhatt, 1998, 2003), but being unpublished documents, they remain as grey literature.

In addition to Auroville and the wetland itself, the watershed region contains many tanks, forests and hillocks which have never been surveyed. This benchmark report documents not only the vertebrate fauna of the wetland and Auroville, but also sacred groves, reserve forests and a granite hillock.

Methods

The Kaliveli watershed region is an area of immense importance from the standpoint of its natural history and potential towards conservation. An 18th century stone unearthed in a village bears inscriptions of a king hunting elephants in this region and historic indications are that the area was heavily forested as recently as 1960 (Pieter, 1987). Yet, a severe lacuna exists concerning documentation of species diversity of inland freshwater fish, amphibians, reptiles other than snakes and mammals. As inventorisation of living resources is of paramount importance to evolve conservation strategies, a survey of specific areas was instituted in July 2002 and lasted till December 2005. Given below is a list of sites sampled during this period:

(i) Kaliveli floodplain (12°5'N-79°47'E & 12°3'N-79°51'E & 12°9'N- 79°53'E): Although called a lake or a tank, it is by definition a floodplain. This petal-shaped waterbody covering an area of *ca.* 7,040ha., is a seasonal freshwater habitat and remains completely dry during the summer months. It begins to fill up with the advent of the southwest monsoon and reaches its maximum extent by the end of the northeast monsoon when the depth can reach 2.1m. Its watershed covers an area of *ca.* 740sq.km. and includes the Auroville plateau to the south, Marakkanam to the north and extends well beyond Tindivanam to the northwest. The copious run-off water from this entire area ultimately reaches the floodplain through more than 250 interconnected tanks and channels. The fauna reported from here not only includes the wetland and its surroundings, but also a different set of species utilising it during the summer months when it is completely dry.

(ii) Uppukalli creek (12°9'N-70°53'E & 12°12'N-79°56'E): A narrow channel that connects the floodplain to the estuary. Owing to its estuarine links, the character of this area is distinct from that of the floodplain. There is constant inflow of water from the estuary throughout the year and the water level and quality varies with the tides. The estuary north of it was not sampled.

(iii) Munoor tank (12°11'N-79°48'E): A perennial catchment, partly natural, partly man-made, its waters are used to irrigate fields in its vicinity. The overflow during the monsoons reaches the floodplain through many interconnected seasonal tanks and channels.

(iv) Thenkodipakkam weir and bridge (12°9'N-79°43'E): A weir and bridge across a water channel that conveys runoff water from the higher reaches of the watershed en route to the floodplain. The bed remains dry during summer, but after the monsoons is seasonally lotic. A perennial tank also exists in the region whose ecology had been disrupted due to aquaculture practices instituted by an NGO - this site was not included in this report, though surveyed (results will be published in a future article).

(v) Urani sacred grove (12°9'N-79°55'E): A minute grove covering an area of 1.5ha. It is the only climax forest in the region. A tall, 3-layered forest, with an average tree height of 8m., it contains a fair representation of trees in the middle and upper stories. It is about 200m. away from human habitation and surrounded on one side by agricultural lands and a road on the other. The dominant vegetation includes *Combretum albidum*, *Derris scandeus*, *Diospyros ebenum*, *Garcinia spicata*, *Lepisanthes tetraphylla* and *Pterospermum canescens* (Venkatreswaran & Parthasarathy, 2003). Along with Puthupet,

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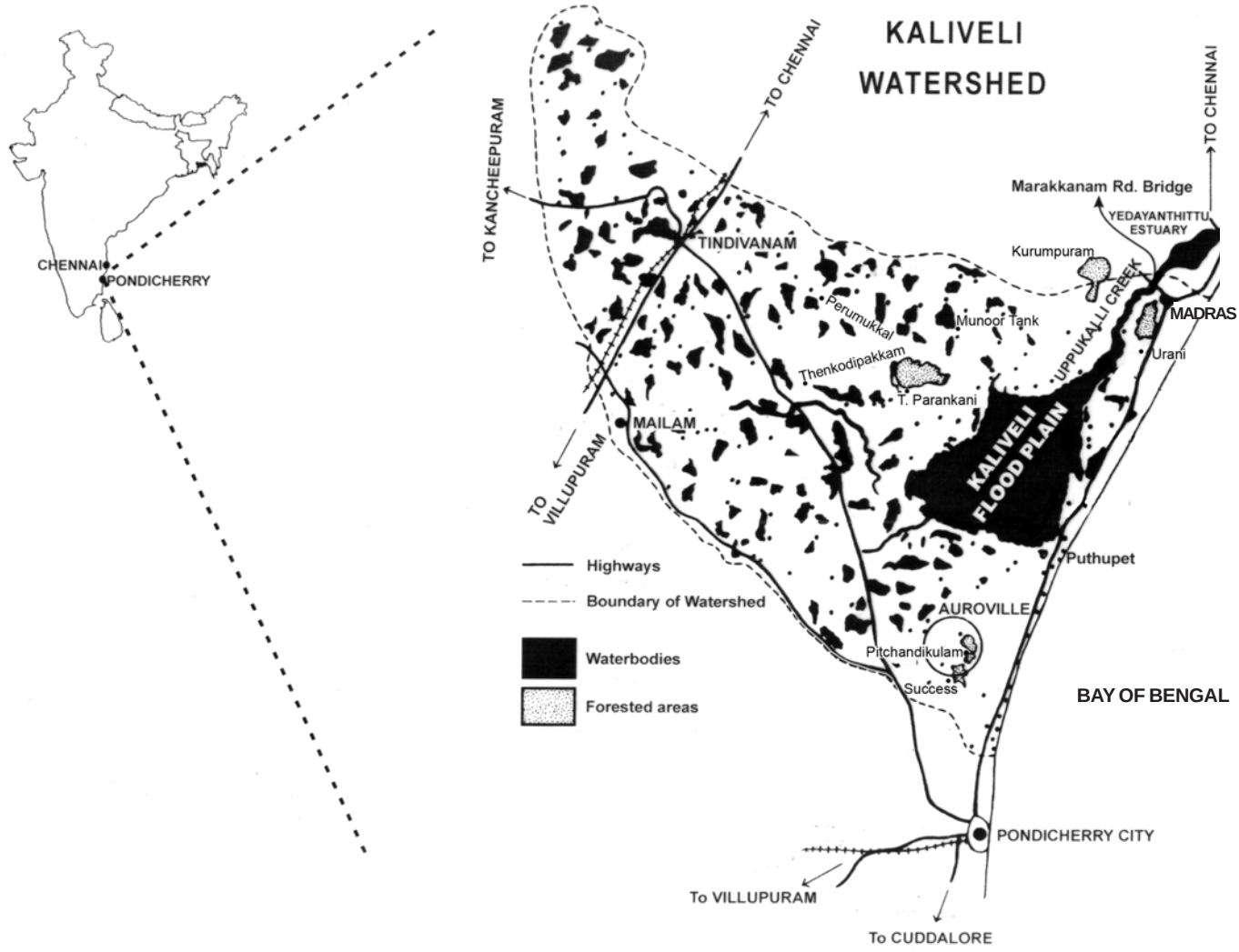

Figure 1. Kaliveli watershed and vertebrate diversity documentation area

it is one of the last fragmented remains of the once widespread tropical dry evergreen forest (TDEF) in the region..

(vi) Puthupet sacred grove (12°3N-79°52'E): It encompasses a total area of 17ha. of which 14ha. remains under vegetal cover. The overstorey is formed by trees such as *Canthium dicoccum*, *Garcinia spicata*, *Pterospermum canescens* and *Lannea coromandelica*, while the middle storey is occupied by *Lepisanthes tetraphylla*, *Memecylon umbellatum* and *Glycosmis pentaphylla*. (Parthasarathy & Sethi, 1997). It is in danger of being wiped out as there is almost no regeneration (Gopinath & Srinivas, 2004).

(vii) Kurumpuram forest (12°4'N-79°44'E): The largest TDEF tract in the region covering an area of *ca.* 240ha. The overall aspect is described as a dense and continuous thicket (scrub jungle) with an average height of 2.5m., from with emerge some small trees. The most common species like *Acacia caesia*, *Capparis stylosa*, *Carissa spinarum*, *Fluggea leucopyrus*, *Gmelina asiatica*, *Hugonia mystax* and *Pterolobium indicum* make the formation impenetrable. Along the roads the exploitation of unarmed shrubs has altered the floristic composition, and here, on the eroded land bereft of topsoil, may be found *Cassia auriculata*, *Dichrostachys cinerea*, *Dodonaea viscosa*, *Euphorbia antiquorum*, *Sanseveria roxburghiana*, etc. (Blasco & Legris, 1972).

(viii) T. Parankani reserve forest (12°13'N-79°53'E): On paper this is the largest vegetated tract covering an area of *ca.* 1500ha., but the majority of space is devoted to *Eucalyptus globulus* plantations. The only remnant TDEF patch is a small L-shaped stretch of land covering an area of *ca.* 75ha., whose physiognomy is similar to Kurumpuram.

(ix) Success canyon (12°13'N-79°53'E): The principal feature of the landscape is a deeply scoured ravine called Nallakuthan Odai, up to 12m. at its deepest point. Though originally planted with exotic *Acacia* spp., the land is now showing signs of recuperation largely due to the regeneration of autochthonous species and the shift in priority of re-establishing the TDEF. Studies here concentrated on the canyon and not on the surrounding plateaux which defies a floristic description due to the over-proliferation of exotic *Acacia auriculiformis*.

(x) Pitchandikulam (11°59'N-79°49'E): A revegetated tract

ca. 30ha. in extent. Reforestation programmes begun in 1973 used exotics like *Acacia auriculiformis*, *Acacia colei*, *Eucalyptus globulus*, etc. Over the last decade or so there has been a significant shift in priority - to recreate the TDEF. As such, many indigenous species are being planted and the exotics removed. The natural vegetation too has begun to recolonize the land, and as such, it can best be described as a mixed forest. In addition, there a tracts of grasslands and meadows *ca.* 2ha. in extent. A seasonal pond exists to the northern side in addition to a number of man made water tanks. An area of *ca.* 2ha. is devoted to agroforestry and an ethno-medicinal forest. A few human residences are present within this forest.

(xi) Perumukkal (12°11'N-79°44'E): A hillock 170m, which occurs on a charnockite outcropping. The biotic variation between the summit and the apron around its base is great (Blanchflower, 2003). Biotic elements display affinities towards types found more commonly in the hills of the Eastern Ghats and these are species that have managed to survive far outside the boundaries of their natural range. As such their genetic value is important and future studies are bound to be very illuminative.

Sampling procedures were diverse and adapted to suit the occasion. Fish were collected with the help of local fishermen who used hand-operated dragnets, casting nets, and the hook and line. In addition, small stranded fish that commercialists ignore were collected by the survey team using dipnets. Identification was according to Daniels (2002); Day (1986a,b); Jayram (1999); Rao (1986); Talwar & Jhingran (1991).

Amphibians were identified using Chanda (2002); Daniel (2002); Daniels (2005). Reptile surveys involved pitfall traps and live captures. Specimens caught were identified and released on the spot, except in the case of geckos whose lamellae were examined under a binocular microscope in the laboratory. Identification of reptiles was according to Daniel (2002); Das (2002); Tikader & Sharma (1992); Whitaker & Captain (2004).

Birdwatching sessions were passive surveys. Identification was according to Ali (1996); Ali & Ripley (1987), and Kazmierczak (2003).

Live trapping of non-volant small mammals was conducted in Auroville forest plantations (Success & Pitchandikulam), but not in sacred groves and reserve forests. The survey methods at the latter mentioned places involved identification of captures by Irulas and villagers (who use them for food) and some natural healers (who use body parts for 'medicinal' purposes). Taxonomic studies of rodents were conducted using specimens trapped and procured from Irulas, natural healers and villagers. Megachiroptera surveys were passive recordings of species encountered on fruit trees, but Microchiroptera were mist netted at their daytime roosts and specimens examined in the laboratory. Mammal identification was according to Agrawal (1967, 2000), Bates & Harrison (1997), Ellerman (1947a, b), Menon (2003), Prater (1993), and Ramanujam (2004).

It must be mentioned that no mist nesting of birds, nor trapping in sacred groves and reserve forests were undertaken. As such some of the rarer, more secretive species may have been overlooked.

Wherever possible IUCN conservation status was determined - for amphibians (Molur & Walker, 1998a), reptiles (Molur & Walker, 1998b), fish (Molur & Walker, 1998c; Rao *et al.*, 1998), mammals (Molur *et al.*, 1998) and Birds (Islam & Rahmani, 2002).

Results and Discussion

Two-hundred-and-seventy taxa belonging to 268 species were found to inhabit the region. Birds dominated with 139 taxa belonging to 137 species (51.11%). This was followed by fish (49 species/18.26%), mammals (38 species/14.17%), reptiles (37 species/13.8%) and amphibians (7 species/2.61%). It was not possible to determine the conservation status of all species from existing literature; the status of only 105 species could be discerned. This included 1 Endagered, 12 Vulnerable, 55 Near Threatened and 37 of Least Concern. The Egyptian Mouth Breeder *Oreochromis mossambica* was the only exotic encountered, and it is considered an alien invasive species (Daniels, 2002; Saxena, 1988). For further details refer Table 1.

Pieter (1987) recorded 125 species of birds in the Kaliveli wetland and its surroundings. He also mentioned "a large concentration of ducks numbering at least 10,000 birds", "both Greater and Lesser Flamingoes", "...observed at one time 10.000 Whiskered Tern "and "one pair of White-bellied Sea Eagles...attending a large eyrie". This survey recorded only 93 species of birds and the ducks encountered numbered not more than 200 individuals. No Lesser Flamingoes nor Sea Eagles were in evidence. Similar comparisons can be made with other authors and the same conclusion drawn - *viz.*, the Kaliveli wetland is a shadow of its former self.

Nevertheless there is hope - for example, a previous survey conducted from 21 July 2003 to 30 April 2004 (Ramanujam, 2005) recorded 42 species of fish in the floodplain and creek. Now it has gone up to 45, and this may be due to the recent efforts of the Government of Tamil Nadu and Department of Forests who have shut down illegal prawn farms and planted mangroves in the creek. If only the wetland can be provided adequate protection from encroachment and poaching, the dynamism of the late 80s and early 90s could easily reassert itself.

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Table 1. Vertebrate diversity of Kalivel watershed region

S.No.	Species	Conservation Status	Occurance											Remarks
			KFl	UCr	Mu	Th	Ur	Ppt	Km	TPr	Ss	Pkm	Pml	
Pisces														
1	Indian Long-finned Eel *Anguilla bengalensis*	EN	P	P	P									Only one adult *ca* 1m long was encountered in the creek in 2005, but many elsewhere captured
2	Snake Eel *Pisodonophis* sp.			P										
3	Indian Shad *Hilsa ilisha*	VU	P	P										
4	Bloch's Gizzard Shad *Nematalosa nasus*	LR-nt	P	P										
5	Gizzard Shad *Nematalosa galatheae*		P	P										
6	Sardine *Clupea* sp.		P	P										
7	Anchovy *Thryssa* sp.			P										
8	Anchovy *Coilia* sp.			P										
9	Milkfish *Chanos chanos*	LR-nt	P	P	P									
10	Spotfin Barb *Puntius sophore*	LR-nt	P	P	P	P								
11	Giant River Catfish *Aorichthys seenghala*		P											
12	Long-whiskered Catfish *Mystus gulio*		P	P		P								
13	Striped Dwarf Catfish *Mystus vittatus*	VU	P	P	P	P						P		
14	Stinging Catfish *Heteropneustes fossilis*	VU	P		P									
15	Marine Catfish *Tachysurus subrostratus*		P											
16	*Tachysurus thassinus*			P										
17	*Tachysurus arius*			P										
18	Black Walking Catfish *Clarius batrachus*	VU	P											
19	Common Mullet *Mugil cephalus*	LR-nt	P	P										
20	Mullet *Liza dussumeri*	LR-nt		P										
21	*Liza macrolepis*	LR-nt		P										
22	*Liza parsia*	LR-nt		P										
23	Congaturi Halfbeak *Hyporhamphus limbatus*		P	P	P									
24	Fullbeak Gar *Strongylura strongylura*			P										
25	Estuarine Ricefish *Oryzias melastigma*		P		P	P								
26	Panchax Minnow *Aplochelius panchax*	DD			P									
27	Glassy Perchlet *Ambassis commersoni*	LR-nt	P	P										
28	Silver Sillago *Sillago sihama*	LR-nt		P										
29	Horse Mackerel *Caranx para*			P										
30	*Leiognathus splendens*	VU		P										
31	*Gerres abbreviatus*			P										
32	Target Perch *Therapon jarbua*	LR-nt		P										
33	*Therapon theraps*			P										
34	Snapper *Lutjanus fulvivlammus*	LR-nt		P										
35	Scat *Scatophagus argus*		P	P										
36	*Siganus javus*	LR-nt		P										
37	Pearl Spot *Etroplus suratensis*		P	P										
38	Spotted Etroplus *Etroplus maculatus*		P	P	P	P								
39	Egyptian Mouth Breeder *Oreochromis mossambica*	Exotic Invasive sp.	P	P	P	P						P		
40	Tank Goby *Glossogobius giurus*	LR-nt	P		P	P						P		
41	Climbing Perch *Anabas testudineus*	VU	P	P	P	P						P		
42	Indian Paradise Fish *Macropodus cupanus*				P									
43	Blackline Rasbora *Parluciosoma daniconius*	LR-nt			P									
44	Malabar Loach *Lepidocephalus thermalis*				P							P		
45	Spotted Snakehead *Channa punctatus*	LR-nt	P		P	P								
46	Striped Snakehead *Channa striatus*	LR-lc	P		P	P						P		
47	Flounder *Pseudorhombus arius*			P										
48	Tripod Fish *Triacanthus brevirostris*			P										
49	Puffer *Tetrodon fluviatilis*			P										
Amphibia														
50	Common Indian Toad *Bufo melanostictus*	VU	P		P		P	P		P	P	P	P	Batrachians were recorded in the floodplain only during the monsoons and in forests with pools or when water stagnated. As soon as inflows into the floodplain stopped and as soon as temporary pools dried up, batrachians were conspicuous by their absence.
51	Painted Kaloula *Kaloula taporbanica*	LR-nt										P		
52	Marbled Balloon Frog *Uperodon systoma*	LR-nt									P	P	P	
53	Common Tree Frog *Polypedates maculatus*	LR-lc					P	P	P	P	P	P	P	
54	Skittering Frog *Euphlyctis cyanophlyctis*	LR-nt	P		P			P	P	P	P	P	P	
55	Indian Pond Frog *Euphlyctis hexadactylus*	LR-nt			P							P	P	
56	Indian Bull Frog *Hoplobatrachus tigerinus*	VU			P				P	P	P			
Reptilia														
57	Indian Pond Terrapin *Melanochelys trijuga*	LR-nt			P				P			P		
58	Indian Flapshell Turtle *Lissemys punctata*	LR-nt			P				P	P		P		
59	Starred Tortoise *Geochelone elegans*	VU										P		Introduced

S.No.	Species	Conservation Status	Occurance											Remarks
			KFl	UCr	Mu	Th	Ur	Ppt	Km	TPr	Ss	Pkm	Pml	
60	Southern House Gecko *Hemidactylus frenatus*	LR-lc					P	P	P	P	P	P	P	
61	Bark Gecko *Hemidactylus leschenaulti*	LR-lc					P	P	P	P	P	P	P	
62	Brook's Gecko *Hemidactylus brooki*	LR-lc									P	P		
63	Termite Hill Gecko *Hemidactylus triedrus*	LR-lc					P	P	P	P	P	P		
64	Peninsular Rock Agama *Psammophilus dorsalis*	LR-nt											P	
65	Common Garden Lizard *Calotes versicolor*	LR-nt					P	P	P	P	P	P		
66	Southern Green Calotes *Calotes calotes*	LR-nt					P						P	
67	Fan-throated Lizard *Sitana ponticeriana*	LR-lc							P	P	P	P		
68	Indian Chameleon *Chameleo zeylanicus*	VU					P	P	P	P	P	P	P	
69	Brahminy Skink *Mabuya carinata*	LR-nt					P	P	P	P	P	P	P	
70	Little Skink *Mabuya macularius*	LR-lc										P		
71	Snake Skink *Riopa punctata*						P	P	P	P	P	P	P	
72	Common Indian Monitor *Varanus bengalensis*	VU					P		P		P	P		
73	Common Worm Snake *Ramphotyphlops braminus*	LR-nt					P	P	P	P	P	P		
74	Beaked Worm Snake *Grypotyphlops acutus*					P	P				P			
75	Common Sand Boa *Eryx conica*	LR-nt					P	P	P	P		P		
76	Red Sand Boa *Eryx johnii*	LR-lc					P	P	P	P	P	P		
77	Comon Trinket Snake *Coelognathus helena*	LR-nt										P		
78	Common Rat Snake *Ptyas mucosus*	LR-nt					P	P	P	P	P	P	P	
79	Common Kukri Snake *Oligodon arnensis*	LR-lc							P		P			
80	Russell's Kukri Snake *Oligodon taeniolatus*	LR-nt					P	P	P	P	P	P		
81	Barred Wolf Snake *Lycodon striatus*	LR-nt					P	P			P	P		
82	Common Wolf Snake *Lycodon aulicus*	LR-lc					P	P	P	P	P	P	P	
83	Common Indian Bronzeback *Dendrelaphis tristis*	LR-lc					P	P	P	P	P	P	P	
84	Common Vine Snake *Ahaetulla nasutus*	LR-nt					P	P	P	P	P	P	P	
85	Indian Cat Snake *Boiga trigonatus*	LR-lc					P	P	P	P	P	P	P	
86	Olivaceous Keelback *Atretium schistosum*	LR-nt	P		P				P					
87	Buffstriped Keelback *Amphiesma stolata*	LR-nt						P	P			P		
88	Checkered Keelback *Xenochrophis piscator*	LR-lc	P		P	P			P			P		
89	Slender Coral Snake *Callophis melanurus*	LR-nt					P							
90	Common Indian Krait *Bungarus caeruleus*	LR-nt						P	P			P		
91	Indian Cobra *Naja naja*	LR-nt	P		P		P	P	P		P	P		
92	Saw-scaled Viper *Echis carinatus*	LR-nt							P	P	P	P		
93	Russell's Viper *Daboia russelli*	LR-nt						P			P	P		
Mammalia														
94	Grey Musk Shrew *Suncus murinus*	LR-lc					P	P	P	P	P	P		
95	Madras Hedgehog *Hemiechinus nudiventris*								P					Dried skins were also seen with natural healers.
96	Fulvous Fruit Bat *Rousettus leschenaulti*	LR-lc					P	P	P		P	P		
97	Indian Flying Fox *Pteropus giganteus*	LR-nt					P	P	P	P	P	P	P	Roosts of this species occur in the villages of Karuperambakka-mand Anumanthai fromwhere they disperse tofeed over the entire area.
98	Short-nosed Fruit Bat *Cynopterus sphinx*	LR-lc					P	P	P	P		P		
99	Long-winged Tomb Bat *Taphozous longimanus*	LR-lc						P						
100	Greater False Vampire *Megaderma lyra*	LR-lc						P			P	P	P	
101	Rufous Horseshoe Bat *Rhinolophus rouxii*	LR-nt						P			P			
102	Dusky Leaf-nosed Bat *Hipposideros ater*	LR-nt									P			
103	Fulvous Leaf-nosed Bat *Hipposideros fulvus*	LR-nt									P			
104	Schneider's Leaf-nosed Bat *Hipposideros speoris*	LR-nt						P						
105	Wrinkle-lipped Free-tailed Bat *Tadarida plicata*						P				P			
106	Asiatic Greater Yellow House Bat *Scotophilus heathii*	LR-lc					P	P				P		
107	Indian Pipistrelle *Pipistrellus coromandra*	LR-nt					P	P	P	P	P	P	P	
108	Painted Bat *Kerivoula picta*	LR-nt										P		
109	Bonnet Macaque *Macaca radiata*	LR-nlc						P	P			P		
110	Black-naped Hare *Lepus nigricollis nigricollis*	LR-lc						P	P	P	P	P		
111	Three-striped Palm Squirrel *Funambulus palmarum*	LR-lc	P				P	P	P	P	P	P	P	
112	Indian Gerbil *Tatera indica*	LR-lc	P				P	P	P	P	P	P		
113	Lesser Bandicoot *Bandicota bengalensis*	LR-lc	P				P	P	P	P	P	P		
114	Large Bandicoot *Bandicota indica*	LR-nt	P				P	P	P	P	P	P		
115	Indian Bush Rat *Golunda ellioti*	LR-lc							P					

S.No.	Species	Conservation Status	Occurance											Remarks
			KFl	UCr	Mu	Th	Ur	Ppt	Km	TPr	Ss	Pkm	Pml	
116	Common House Rat *Rattus rattus*	LR-lc	P				P	P	P	P	P	P	P	
117	White-tailed Wood Rat *Cremnomys blanfordi*	LR-nt							P					
118	Soft-furred Field Rat *Millardia meltada*	LR-lc	P						P	P				
119	House Mouse *Mus musculus*	LR-lc	P				P	P	P	P	P	P	P	
120	Little Indian Field Mouse *Mus booduga*	LR-lc	P				P	P	P	P	P	P		
121	Wroughton's Small Spiny Mouse *Mus phillipsi*	LR-lc											P	
122	Elliot's Spiny Mouse *Mus saxicola*	LR-lc							P	P				
123	Long-tailed Tree Mouse *Vandeleuria oleracea*	LR-lc					P	P				P		
124	Indian Crested Porcupine *Hystrix indica*	LR-lc							P	P	P			
125	Indian Pangolin *Manis crassicaudata*	LR-nt								P				Bones and scales found in possession of a natural healer – the only evidence recorded.
126	Jungle Cat *Felis chaus*	LR-nt												
127	Common Palm Civet *Paradoxurus hermaphroditus*	LR-lc						P	P	P	P	P		
128	Small Indian Civet *Viverricula indica*	LR-nt										P		
129	Common Mongoose *Herpestes edwardsi*	LR-lc	P				P	P	P	P	P	P	P	
130	Jackal *Canis aureus*	LR-lc	P						P	P	P	P	P	
131	Indian Fox *Vulpes bengalensis*	LR-nt							P					
Aves														
132	Little Grebe *Tachybabtus ruficollis*		P		P									
133	Little Cormorant *Phalacrocorax niger*		P		P									
134	Darter *Anhinga melanogaster*	LR-nt	P											
135	Spot-billed Pelican *Pelecanus philippensis*	VU	P	P										
136	Intermediate Egret *Mesophox intermedia*		P	P	P									
137	Little Egret *Egretta garzetta*		P		P									
138	Cattle Egret *Bubulcus ibis*		P		P									
139	Grey Heron *Ardea cinerea*		P		P		P							Urani is the only known roost for the species in this region
140	Purple Heron *Ardea purpurea*		P		P									
141	Indian Pond Heron *Ardeola grayi*		P		P	P		P			P	P		
142	Black-crowned Night Heron *Nycticorax nycticorax*		P		P									
143	White Stork *Ciconia ciconia*		P		P									
144	Painted Stork *Mycteria leucocephala*	LR-nt	P	P										
145	Asian Openbill *Anastomus oscitans*		P	P	P									
146	Black-headed Ibis *Threskiornis melanocephalus*	LR-nt	P											
147	Glossy Ibis *Plegadis falcinellus*		P											
148	Greater Flamingo *Phoenicopterus ruber*		P	P										
149	Northern Pintail *Anas acuta*		P											
150	Eurasian Wigeon *Anas penelope*		P											
151	Garganey *Anas querquedula*		P											
152	Northern Shoveler *Anas clypeata*		P											
153	Spot-billed Duck *Anas poecilorhyncha*		P											
154	Black-shouldered Kite *Elanus caeruleus*		P						P		P	P		
155	Pariah Kite *Milvus migrans govinda*		P					P	P	P	P	P	P	
156	Brahminy Kite *Haliastur indus*		P	P	P				P					
157	Oriental Honey Buzzard *Pernis ptilorhynchus*		P						P	P	P	P	P	
158	Shikra *Accipiter badius*						P	P	P	P	P	P		
159	White-eyed Buzzard *Butastur teesa*		P											
160	Pallid Harrier *Circus macrourus*	LR-nt	P											
161	Montagu's Harrier *Circus pygargus*		P											
162	Pied Harrier *Circus melanoleucos*		P											
163	Marsh Harrier *Circus aeruginosus*		P											
164	Crested Serpent Eagle *Spilornis cheela*										P			
165	Peregrine Falcon *Falco peregrinus calidus*		P								P			
166	Shaheen Falcon *Falco peregrinus peregrinator*												P	Observed only on a coupleof occasions.
167	Kestrel *Falco tinnunculus*		P						P	P	P	P	P	
168	Grey Francolin *Francolinus pondicerianus*		P					P	P	P	P	P		
169	Indian Peafowl *Pavo cristatus*										P	P		Introduced
170	Jungle Bush Quail *Perdicula asiatica*								P		P			
171	White-breasted Waterhen *Amaurornis phoenicurus*		P		P									
172	Common Moorhen *Gallinula chloropus*		P		P									
173	Common Coot *Fulica atra*		P		P									
174	Pheasant-tailed Jacana *Hydrophsianus chirurgus*				P									
175	Pied Avocet *Recurvirostra avocetta*			P										

S.No.	Species	Conservation Status	Occurance											Remarks
			KFl	UCr	Mu	Th	Ur	Ppt	Km	TPr	Ss	Pkm	Pml	
176	Black-winged Stilt *Himantopus himantopus*		P	P										
177	Indian Courser *Cursorius coromandelicus*		P											
178	Yellow-wattled Lapwing *Vanellus malabaricus*		P	P										
179	Red-wattled Lapwing *Vanellus indicus*		P	P	P				P		P			
180	Little Ringed Plover *Charidius dubius*		P	P										
181	Pacific Golden Plover *Pluvalis fulva*		P	P										
182	Spotted Redshank *Tringa erythropus*		P	P										
183	Common Redshank *Tringa totanus*			P										
184	Common Greenshank *Tringa nebularia*		P	P										
185	Green Sandpiper *Tringa ochropus*			P										
186	Wood Sandpiper *Tringa glareola*			P										
187	Comman Sandpiper *Actitis hypoleucos*		P		P									
188	Pintail Snipe *Gallinago stenura*		P											
189	Comman Snipe *Gallinago gallinago*		P											
190	Temminck's Stint *Calidris ferruginea*		P		p									
191	Brown-headed Gull *Larus brunnicephalus*			P										
192	Black-headed Gull *Larus ridibundus*			P										
193	River Tern *Sterna aurantia*		P	P	P									
194	Whiskered Tern *Chlidonias hybridus*			P										
195	Spotted Dove *Streptopelia chinensis*		P				P	P	P	P	P	P		
196	Eurasian Collared Dove *Streptopelia decaocto*		P											
197	Rock Pigeon *Columba livia*										P		P	
198	Pompadour Green Pigeon *Treron pompadora*						P					P		
199	Rose-ringed Parakeet *Psittacula krameri*		P				P	P	P	P	P	P		
200	Chestnut-winged Cuckoo *Clamator coromandus*							P	P			P		
201	Pied Cuckoo *Clamator jacobinus*							P	P		P	P		
202	Common Hawk Cuckoo *Hierococcyx varius*		P				P	P	P	P	P	P	P	
203	Asian Koel *Eudynamys scolopacea*		P				P	P	P	P	P	P	P	
204	Greater Coucal *Centropsis sinensis*		P				P	P	P	P	P	P	P	
205	Barn Owl *Tyto alba*										P		P	
206	Collared Scops Owl *Otus bakkamoena*						P	P	P	P	P	P	P	
207	Indian Eagle Owl *Bubo benganlensis*										P		P	
208	Mottled Wood Owl *Strix ocellata*							P			P	P		
209	Spotted Owlet *Athene brama*		P				P	P	P	P	P	P	P	
210	Brown Hawk Owl *Ninox scutulata*						P							Observed only once.
211	Indian Nightjar *Caprimulgus asiaticus*		P				P	P	P	P	P	P	P	
212	Asian Palm Swift *Cypsurus parvus*		P				P	P	P	P	P	P	P	
213	Pied Kingfisher *Ceryle rudis*		P	P	P									
214	Common Kingfisher *Alcedo atthis*		P	P	P							P		
215	White-throated Kingfisher *Halcyon smyrnensis*		P	P	P					P	P	P	P	
216	Blue-tailed Bee-eater *Merops philippinus*		P		P				P					
217	Green Bee-eater *Merops orientalis*		P						P	P				
218	Indian Roller *Coracias bengalensis*		P					P	P	P		P	P	
219	Hoopoe *Upupa epops*						P	P	P	P	P	P	P	
220	Coppersmith Barbet *Megalaima haemacephala*						P	P	P		P	P		
221	Black-rumped Flameback *Dinopium benghalese*						P	P	P		P	P		
222	Indian Pitta *Pitta brachyura*						P	P	P		P	P	P	
223	Common Iora *Aegithina tiphia*						P	P				P		
224	Blue-winged Leafbird *Chloropsis cochinchinensis*						P					P		
225	Eurasian Golden Oriole *Oriolus oriolus*								P	P		P	P	
226	Jerdon's Bushlark *Mirafra affinis*		P											
227	Ashy-crowned Sparrow Lark *Eremopterix grisea*		P											
228	Oriental Skylark *Alauda gulgula*		P											
229	Barn Swallow *Hirundo rustica*								P	P	P		P	
230	Black Drongo *Dicrurus macrocercus*		P				P	P	P	P	P	P	P	
231	Ashy Woodswallow *Artamus fuscus*							P				P	P	
232	Common Woodshrike *Tephrodornis pondicerianus*											P		
233	Black-headed Cuckoo Shrike *Coracina melanoptera*											P		
234	Brahminy Starling *Sturnus pagodarium*							P			P	P		
235	Rosy Starling *Sturnus roseus*		P		P									
236	Common Myna *Acridotheres tristis*		P				P	P	P	P	P	P	P	
237	Rufous Treepie *Dendrocitta vagabunda*		P				P	P	P	P	P	P	P	
238	House Crow *Corvus splendens*		P	P	P	P	P	P	P	P	P	P	P	
239	Large-billed Crow *Corvus macrorynchos*		P				P	P	P	P	P	P		

S.No.	Species	Conservation Status	Occurance										Remarks
			KFl	UCr	Mu	Th	Ur	Ppt	Km	TPr	Ss	Pkm	Pml	
240	Small Minivet *Pericrocotus cinnamomeus*						P							
241	Black-headed Cuckoo Shrike *Coracina melanoptera*		P									P		
242	Red-vented Bulbul *Pycnonotus cafer*		P				P	P	P	P	P	P	P	
243	White-browed Bulbul *Pycnonotus luteolus*							P				P		
244	Jungle Babbler *Turdoides striatus*						P	P	P	P	P	P		
245	Yellow-billed Babbler *Turdoides affinis*								P	P	P	P		
246	Common Babbler *Turdoides caudatus*		P				P	P	P	P	P	P	P	
247	Asian Paradise Flycatcher *Terpsiphone paradisi*						P	P			P	P		
248	Black-naped Monarch *Rhipidura azurea*						P	P				P		
249	White-browed Fantail *Rhipidura aureola*										P	P		
250	Blyth's Reed Warbler *Acrocephalus dumetorum*		P											
251	Common Tailorbird *Orthotomus sutorius*		P				P	P	P	P	P	P	P	
252	Oriental Magpie Robin *Copsychus saularis*		P				P	P	P	P	P	P	P	
253	Indian Robin *Saxicoloides fulicata*		P				P	P	P	P	P	P	P	
254	Orange-headed Thrush *Zoothera citrina citrina*											P	P	
255	*Zoothera citrina cyanotus*											P		
256	Paddyfield Pipit *Anthus rufulus*		P											
257	White-browed Wagtail *Motacilla maderaspatensis*		P		P						P	P	P	
258	Grey Wagtail *Motacilla cinerea*		P		P									
259	White Wagtail *Motacilla alba*				P								P	
260	Yellow Wagtail *Motacilla flava*				P								P	
261	Purple-rumped Sunbird *Nectarinia zeylonica*						P	P	P	P	P	P		
262	Loten's Sunbird *Nectarinia lotenia*						P	P	P	P	P	P		
263	Purple Sunbird *Nectarinia asiatica*		P				P	P	P	P	P	P	P	
264	Thick-billed Flowerpecker *Dicaeum agile*						P	P			P	P		
265	Pale-billed Flowerpecker *Dicaeum erythrorhynchos*		P				P	P	P	P	P	P	P	
266	Indian Silverbill *Lonchura malabarica*		P						P	P				
267	Scaly-breasted Munia *Lonchura punctulata*		P						P	P		P		
268	Black-headed Munia *Lonchura malacca*		P						P					
269	House Sparrow *Passer domesticus*		P				P	P	P	P	P	P	P	
270	Baya Weaver *Ploceus philippinus*		P											

Occurrence: KFl - Kaliveli Floodplain; UCr - Uppukalli Creek; Mu - Munoor Tank; Th - Thenkodipakkam Weir and Bridge; Ur - Urani Sacred Grove; Ppt - Puthupet Sacred Grove; Km - Kurumpuram Reserve Forest; TPr - T.Parankani Reserve Forest; Ss - Success Canyon; Pkm - Pitchandikulam; Pml - Perumukkal.
Conservation Status: EN - Endangered; VU - Vulnerable; LR-nt - Lower Risk, near threatened; LR-lc - Lower Risk-least concern

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SOME MACROFUNGI OF PHULWARI WILDLIFE SANCTUARY, RAJASTHAN

Satish Kumar Sharma

Foundation For Ecological Security, 18, New Ahinsapuri, Fatehpura, Udaipur, Rajasthan 313001, India
Email: sksharma56@gmail.com

Phulwari Wildlife Sanctuary, situated at the southernmost tip of Rajasthan state near Gujarat border, experiences high rainfall, relative humidity and temperature. The presence of enormous quantity of dead and fallen wood provide congenial environment for fungi to grow. Macrofungi produce large and conspicuous fruit bodies, which have characteristic structure and appearance, which help in identification (Leelavathy & Ganesh, 2000). Six species have been identified from Phulwari Wildlife Sanctuary (See Table below)

The macrofungi of Phulwari belong to three families. Members of the Polyporaceae family are more common than the other families. These macrofungi are responsible for the rot in fallen wood logs on the forest floor and are commonly seen during monsoon season. They are also present in Kumbhalgarh and Sitamata sanctuaries of southern Rajasthan.

Besides macrofungi, many macroscopic lichens are also present in the State. During year 2002, an ash-coloured crustaceous lichen was collected from the inner surface of the southern wall of Kumbhalgarh fort and was identified as *Leraria* sp. This species is commonly present at Gogunda, Jaswantgarh, Mt. Abu, Phulwari Sanctuary, Avargarh (Kamalnath), Nalmokhi, Bagdunda and Sitamata Sanctuary. It is commonly spotted on tree trunks with rough surface like *Phoenix sylvestris* or rough bark like *Ziziphus mauritiana* and *Mangifera indica*.

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Species	Status	Grows on
Agaricaceae		
Agaricus sp.	Common	decaying logs of *Boswellia serrata*
Polyporaceae		
Polyporus picipus	Common	decaying wood logs
Polyporus sanguineus	Less Common	decaying wood logs
Lenzites betulina	Common	decaying wood logs
Microporus xanthopus	Common	decaying wood logs
Ganodermataceae		
Ganoderma sp.	Very Common	stem of green trees

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