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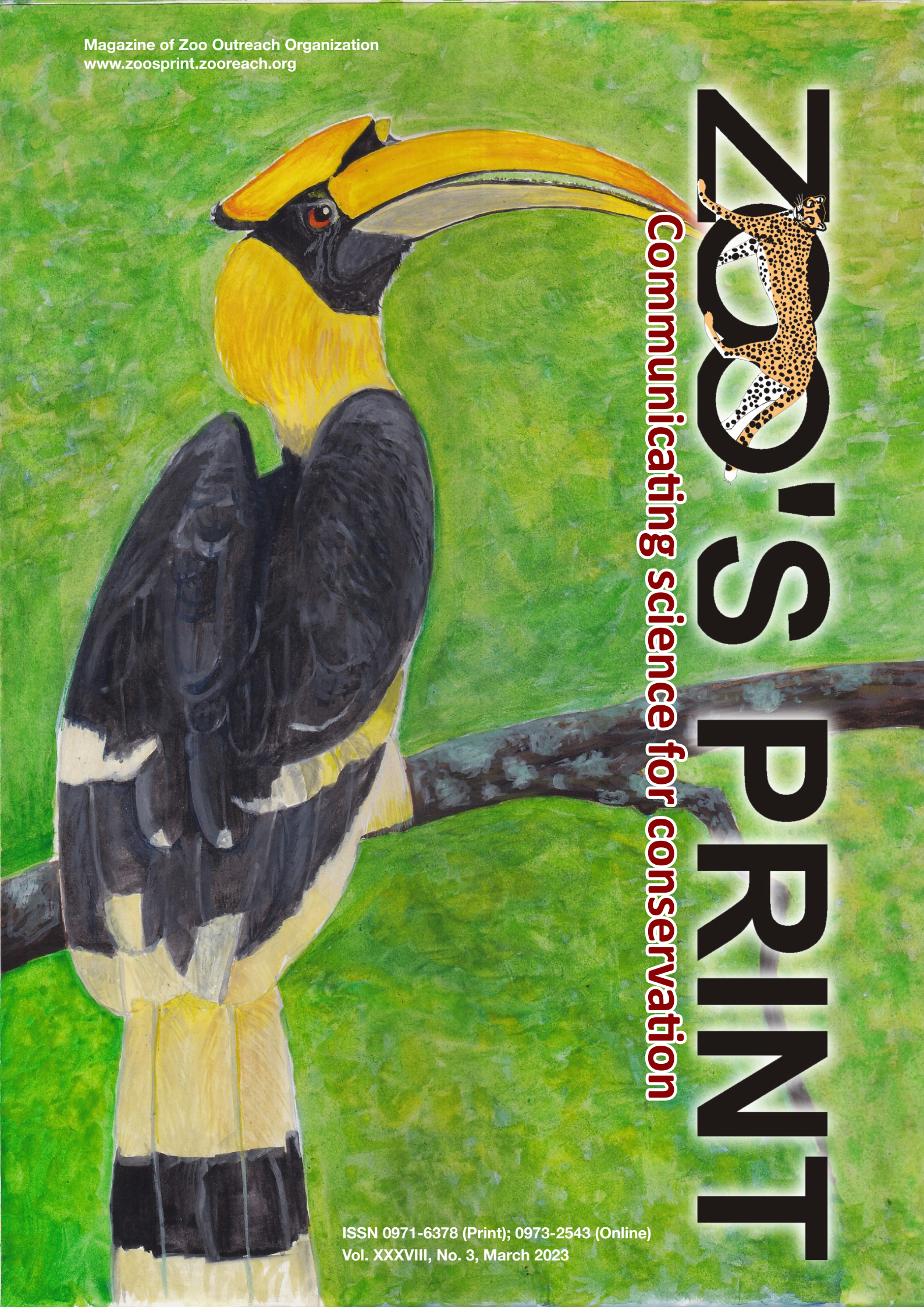
ZOO'S PRINT

Communicating science for conservation



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Cover photo: Great hornbill (*Buceros bicornis*) in poster colors. © Rajib Saha.

#230
21 March 2023

Common Sand Boa predation on a Common Myna

Common Sand Boa *Eryx conicus* is widely distributed in Pakistan, Nepal, India, and Sri Lanka (Uetz et al. 2020). This species is common throughout India, except in the north-east and Andaman & Nicobar Islands (Srinivasulu et al. 2014). This burrowing, semi-fossorial, nocturnal (occasionally found in the daytime) snake inhabits arid, semi-arid, deciduous forests, and agricultural fields in newly developed urban areas.

The Sand Boa is an ambush predator that hides below the sandy soil surface, keeping only its eyes and nostrils above the surface. When the prey comes close enough, the snake suddenly projects itself out of its hiding place and strikes and grabs the prey (Srinivasulu et al. 2014).

A large Common Sand Boa *Eryx conicus* with its prey as a Common Myna *Acridotheres tristis*, Vadodara, Gujarat. © Vedant K. Upadhyay.

We noticed a similar ambush-predating behaviour of the species. On 16 July 2022, we saw an individual of *E. conicus* trying to engulf a Common Myna *Acridotheres tristis* on an open plot of land (22.2966° & 73.1385°) near the residential area of Vasna, is a newly developed area of the urban city of Vadodara, Gujarat, India. We noticed an adult Common Sand Boa catching a common myna in the undergrowth of vegetation, when we heard a stress calls of a bird. The Boa was able to disappear into dense bushes with its prey bird. Therefore, we cannot observe whether it swallows the Myna or not, but such observation shows the Boa is a master of catching a small number of birds.

The published literature shows *E. conicus* feeds mainly on lizards, rodents, frogs, small mammals, and birds, like Myna, Hoopoe, babblers, and quails (Daniel 2002; Whitaker & Captain 2004). Recent literature shows the species also feed Bengal Monitor *Varanus bengalensis* (Bhardwaj 2018) and Ashy Prinia *Prinia socialis* (Jadav et al. 2022). Earlier, similar observations as Common Sand Boa feeding on myna were noticed by Maurya (2020: https://www.indianreptiles.org/#!/sp/176/Eryx-conicus) and Singh (2021: https://www.wealthywaste.com/rough-scaled-sand-boa-gongylophis-conicus) at Saket Metro station, Dehli and the Keoladeo Ghana National Park at Rajasthan was trying to ingest a bird (Mynah) during the daytime as boa was predated on a Common Myna, respectively.

This Boidae species *E. conicus* is categorized as 'Near Threatened' under IUCN Red List due to tread and extensive habitat loss (Srinivasulu et al. 2021). The present observation shows the species surviving in newly developed, highly populated areas of Vadodara city. It is the second photographic record of the species preying on Myna bird.

References

Bhardwaj, D. (2018). Rough-scaled Sand Boa (*Eryx conicus*) predation on a Bengal Monitor (*Varanus bengalensis*). *Biawak* 1(1): 34.
Daniel, J.C. (2002). *The Book of Indian Reptiles and Amphibians*. Oxford University Press / Bombay Natural History Society, Oxford, 141 pp.
Jadav, M., S. Kininge & O.V. Yadav (2022). Common Sand Boa *Eryx conicus* (Family Boidae), a predator of Ashy Prinia *Prinia socialis*. *Journal of the Bombay Natural History Society* 119.
Srinivasulu, S., B. Srinivasulu & S. Molur (Compilers) (2014). *The Status and Distribution of Reptiles in the Western Ghats, India*. Conservation Assessment and Management Plan (CAMP). Wildlife Information Laision Development Society, Coimbatore, Tamil Nadu, 148 pp.
Srinivasulu, C., R. Vyas, S. Bhattarai, S. Thakur, S. Narayanan, M. Suraj, S. Molur, K. Ukuwela & L.J.M. Wickramasinghe (2021). *Eryx conicus*. The IUCN Red List of Threatened Species 2021: e.T13264817A1362030. Accessed 10 November 2022. https://doi.org/10.2305/IUCN.UK.2021-2.RLTS.T13264817A1362030.en
Uetz, P., P. Freed & J. Hošek (2020). The Reptile Database. https://www.reptile-database.org. Accessed 28 August 2022.
Whitaker, R. & A. Captain (2004). *Snakes of India. The Field Guide*. Draco Books, Chengalpattu, Tamil Nadu, 479 pp.

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BugsEAll

#264
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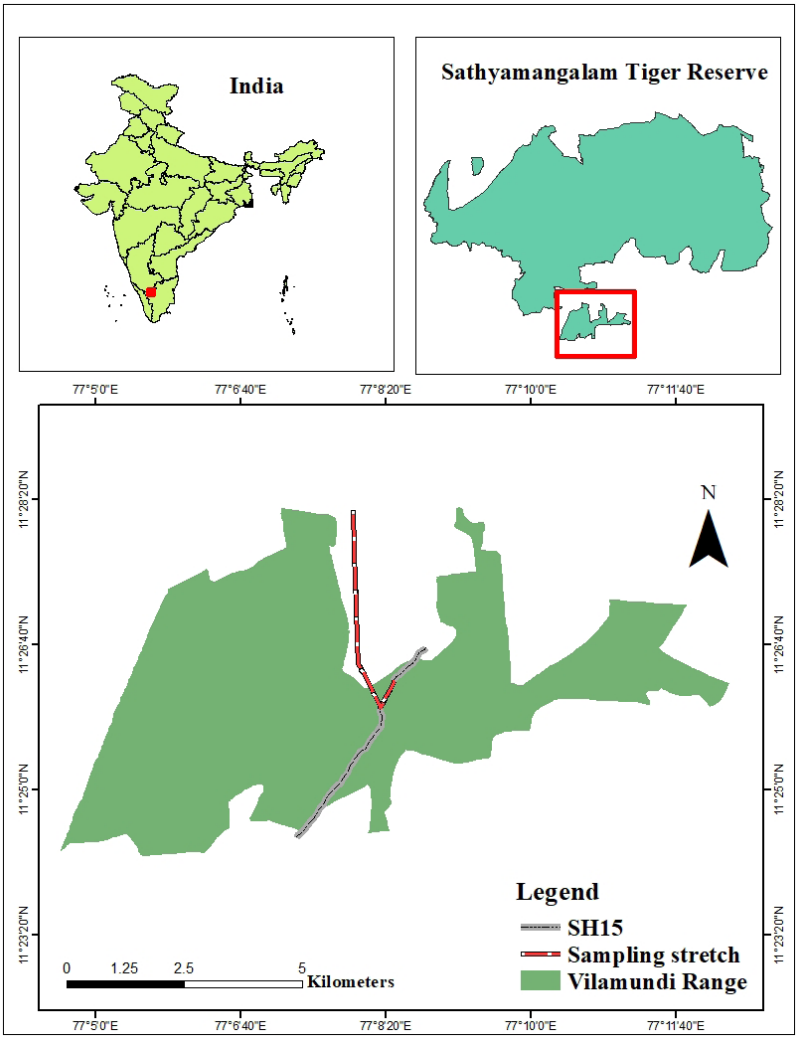
Road mortality of butterflies in the Bhavanisagar -Mettupalayam Road, Sathyamangalam Tiger Reserve, Tamil Nadu, India

The most noticeable impacts of roads are perhaps associated with vehicle collisions. Roads are the line corridors that can cause high mortality risks where traffic volume is high (Samways 1994). Butterflies are one of the most common insect groups killed on roads by vehicles; however, the effects of road traffic on butterflies have been poorly studied in India. The impact of road mortality is expected to be high in insects than in other taxa (Rao & Girish 2007).This study documents the road mortality of butterflies at Sathyamangalam Tiger Reserve over a short period of time during the summer month.

The study area is part of the Vilamundi Forest Range of the Sathyamangalam Tiger Reserve (STR), Tamil Nadu. The STR is a connective junction of Eastern and Western Ghats, which is one of the largest tiger reserves of Tamil Nadu (10.4875–11.71972°N & 76.84611–77.45611° E) established in 2013 and which covers an area of 1,400 km^2.

We selected a 5-km road stretch from Bhavanisagar to the Nalroad and a portion from SH 15 that runs from Erode to Gudalur, Tamil Nadu. The road



Vilamundi Forest Range of Sathyamangalam Tiger Reserve.

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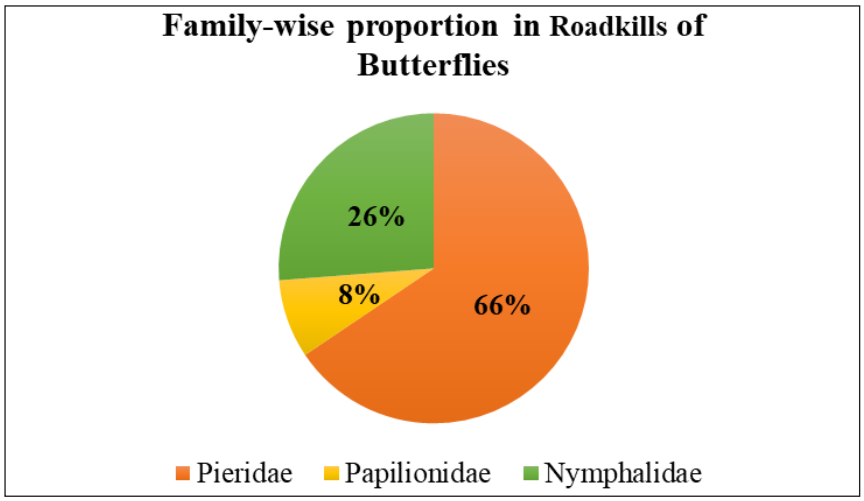
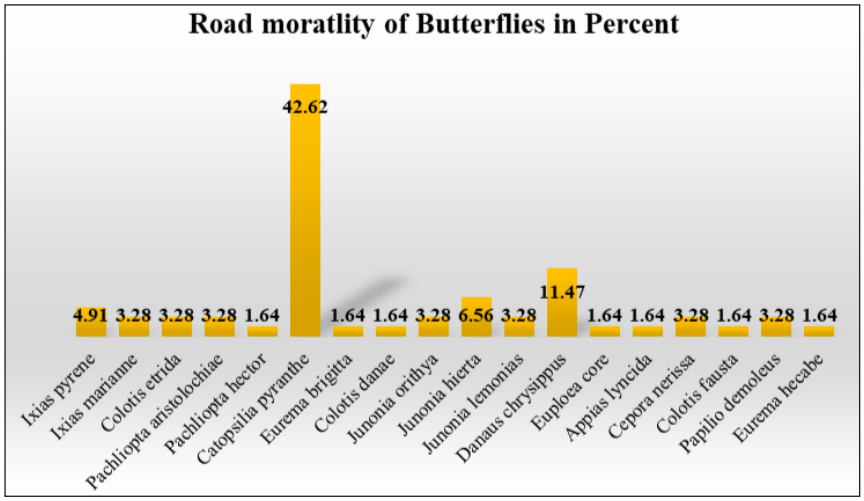


Proportion of family-wise roadkills in butterflies.



Proportion of road kills in butterflies.

passes through the tropical thorn forest patch of the STR.

Field observation was made on six days in the month of June 2018. The survey was conducted between 0830 h and 1130 h. A checklist was prepared based on the study of road-killed butterflies in Bhavanisagar to Nalroad. The butterfly number was quantified through the roadside walk, and the return walk was on the opposite side of the first walk. Road kills were photographed from the spot and identified with the help of a field guide (Kasambe 2018).

We encountered roadkills of 61 individuals in six days of June 2018, which consisted of 18 species, 11 genera, and three families, respectively (Table 1). Among the roadkills, 66% belonged to the Pieridae family, followed by Nymphalidae 26%, and Papilionidae 8%. Mottled Emigrant *Catopsilia pyranthe* was the most affected species by road kills 42.62%, followed by Plain Tiger *Danaus chrysippus* 11.47%.

Mainly, road kill studies focus on bigger animals in India, such as mammals, reptiles, birds, and amphibians. Similar road kill studies on butterflies have been conducted in the Indian landscape on a small scale. Rao & Girish (2007) have observed road kill of 1,269 individuals from the Bandipur National Park; among them, 35% were butterflies. Similarly, the Wayanad District of Kerala was reported to have lost nearly 206 butterflies due to vehicle collisions over a day; all were under two families and the highest number of individuals road killed were the

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A view of butterfly road kills at the Vilamundi Range of Sathyamangalam Tiger Reserve: 1—Common Crow | 2—Chocolate Albatross | 3—Mottled Emigrant | 4—Common Rose | 5—Lemon Pansy | 6—Common Grass Yellow | 7—Large Salmon Arab | 8—Small Grass Yellow | 9—Yellow Pansy © Vishnu, C.S.

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A view of butterfly road kills at the Vilamundi Range of Sathyamangalam Tiger Reserve: 10—Crimson Tip | 11—Blue Pansy | 12—Plain Tiger | 13—White Orange-tip | 14—Crimson Rose | 15—Yellow Orange-tip | 16—Common Gull | 17—Lime Butterfly. © Vishnu, C.S.

Table1. Checklist of the road killed butterflies.

	Common Name	Family	Binomial Name	Count
1	Yellow Orange-tip	Pieridae	*Ixias pyrene*	3
2	White Orange-tip	Pieridae	*Ixias marianne*	2
3	Small Orange-tip	Pieridae	*Colotis etrida*	2
4	Crimson Tip	Pieridae	*Colotis danae*	1
5	Large Salmon Arab	Pieridae	*Colotis fausta*	1
6	Common Grass Yellow	Pieridae	*Eurema hecabe*	1
7	Small Grass Yellow	Pieridae	*Eurema brigitta*	1
8	Mottled Emigrant	Pieridae	*Catopsilia pyranthe*	26
9	Chocolate Albatross	Pieridae	*Appias lyncida*	1
10	Common Gull	Pieridae	*Cepora nerissa*	2
11	Blue Pansy	Nymphalidae	*Junonia orithya*	2
12	Yellow Pansy	Nymphalidae	*Junonia hierta*	4
13	Lemon Pansy	Nymphalidae	*Junonia lemonias*	2
14	Plain Tiger	Nymphalidae	*Danaus chrysippus*	7
15	Common Crow	Nymphalidae	*Euploea core*	1
16	Common Rose	Papilionidae	*Pachliopta aristolochiae*	2
17	Crimson Rose	Papilionidae	*Pachliopta hector*	1
18	Lime Butterfly	Papilionidae	*Papilio demoleus*	2

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Blue Tigers *Tirumala septentrionis* (Roshnath & Cyriac 2013). Also, Sony & Arun (2015) have documented 135 butterfly road kills belonging to three families, nine genera, and 12 species in the Anaikkatty Hills of Tamil Nadu; among them, the proportion of nymphalid butterflies was high at 70%.

However, a total of about 61 individuals' deaths during a shorter span is a call for proper investigation in this region. Insects are essential to the ecosystem as pollinators; still, very few conservation efforts have been made to protect them. However, we suggest that butterfly populations must be protected from road deaths through meaningful conservation measures in the future.

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References

Kasambe, R. (2018). *Butterflies of Western Ghats.* 2nd Edition. Published by author, 372 pp.

Rao, R.S.P. & M.K.S. Girish (2007). Road kills: Assessing insect casualties using flagship taxon. *Current Science* 92(6): 830–837.

Roshnath, R. & V.P. Cyriac (2013). Way Back Home-Butterfly Roadkills. *Zoo's Print* 28(12): 18–20.

Samways, M.J. (1994). *Insect Conservation Biology*. Chapman & Hall, London, 358 pp.

Sony, R.K. & P.R. Arun (2015). A case study of butterfly road kills from Anaikatty Hills, Western Ghats, Tamil Nadu, India. *Journal of Threatened Taxa* 7(14): 8154–8158.

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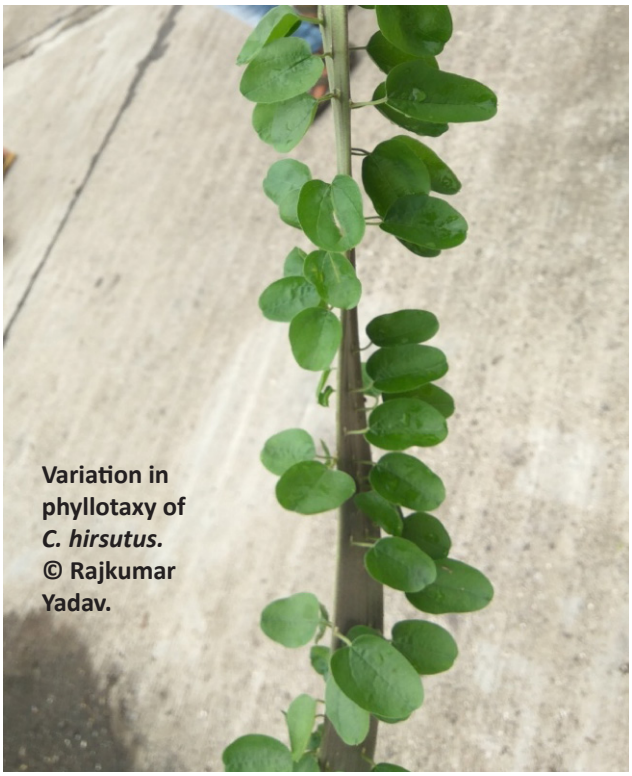
A record of stem fasciation phenomenon in *Cocculus hirsutus* (L.)

Fasciation phenomenon is not rare in plants rather widely known in the plant kingdom (Barannon 1914). The term is originated from the Latin word 'fascis', which means 'bundle' and could appear in different plant organs (Iliev & Kitin 2010). In this phenomenon, the broadening of the shoot apical meristem, flattening of the stem and changes in phyllotaxy may be observed in various plant species (Iliev & Kitin 2010).

Fasciated stem of *C. hirsutus*. © Rajkumar Yadav.

Literature survey showed that most of the fasciation has/had been reported in trees, shrubs, flowers, and cacti belonging to 107 families, more frequently in Rosaceae, Ranunculaceae, Liliaceae, Euphorbiaceae, Crassulaceae, Leguminosae, Onagraceae, Compositae, and Cactaceae (White 1948; Binggeli 1990). The study of fasciation subject is known as teratology, meaning the study of physiological abnormailities (Bos 1957; Binggeli 1990). During a personal field visit to the Tapi District (21.0511° N & 73.2482° E), Gujarat, India, a remarkable natural stem fasciation phenomenon was noticed in *Cocculus hirsutus* (L.) Diels, where the stem had converted into a flattened and ribbed structure, as shown in the figure, which was different from the normal plant of the same species. On the examined stem, the phyllotaxy of *Cocculus hirsutus* (L.) was also found to be different than the normal individual of the species, which may change periodically as described by Bausor (1937) in *Phaseaolus multiflorus*



Variation in phyllotaxy of *C. hirsutus*. © Rajkumar Yadav.

Willd. Similar leaf arrangment is also described by El-Banna et al. (2013) in fasciated stem. The species was identified as *Cocculus hirsutus* (L.) using the Flora of Gujarat State prepared by Shah (1978) and herbarium of GEER Foundation located in Gandhinagar, Gujarat, India. The specimen of this species was collected and the voucher specimen 02352 (GEER) was deposited in herbarium of GEER Foundation for reference purposes. *Cocculus hirsutus* (L.) is an evergreen, perennial climber species belonging to Menispermaceae, an angiosperm family. It is also known as the broom creeper plant and is widely distributed throughout India, especially in dry regions of the country (Goodla et al. 2017).

As per the available literature and sources known to us, fasciation has not been reported in the species *Cocculus hirsutus* (L.) but, fascinated, flattened, wide and ribbed type of interesting phenomenon had been reported by Odneal (2016) in Sweet Potato *Ipomoea batatas* L. (Lam.), which he thought could be due to hormonal imbalance from mutation or other factors. Fasciation phenomena is also noted in *Senna surattensis* (Sunshine tree) which was found to be due to phytoplasmic infection (Wu et al. 2011).

Observation during the current study revealed the stem to be as broad as 3.5 cm, which looked like a pant belt. Other morphological features such as leaf size (1.5–6 × 0.5–2.5cm) and shape (ovate, obtuse, or mucronate at apex, rounded or truncate at base) were found to be almost similar to the normal individual of *Cocculus hirsutus* (L.). As per various experiments done by White (1948), fasciation phenomenon may be due to infection (by bacteria and viruses), chemical or mechanical damage, somatic mutation, hormonal imbalance, and environmental causes. The current observational study documented a stem fasciation phenomenon in *Cocculus hirsutus* (L.) which was unknown yet in this species and a detailed study of teratology is required to know the teratogen responsible for this character of the plant.

References

Barannon, M.A. (1914). Fasciation. *Botanical Gazette* 58: 518–526.

Bausor, S.C. (1937). Fasciation and its relation to problems of growth I. Shape changes in the shoot. *Bulletin of the Torrey Botanical Club* 64(6): 383–400.

Binggeli, P. (1990). Occurence and cause of fasciation. *Cecidology* 5: 57–62.

Bos, L. (1957). Plant teratology and plant pathology. *European Journal of Plant Pathology* 63: 222–231.

El_Banna, A.L., M.F. El-Nadi, Y.H. Devir & M.E. El-Mahrouk (2013). Stem facsiation in cacti and succulent species- tissue anatomy, protein pattern and RAPD polymorphism. *Acta Biologica Hungaria* 64(3): 305–318.

Goodla, L., M. Manubolu, K. Pathakoti & P.R. Poondamalli (2017). Preventive and Curative effects of *Cocculus hirsutus* (Linn.) Diels leaves extracts on CCl4 provoked hepatic injury in rats. *Egyptian Journal of Basic and Applied Sciences* 4(4): 264–269.

Iliev, I. & P.B. Kitin (2010). Origin, morphology and anatomy of fasiation in plant cultured in *vivo* and *vitro*. *Plant Growth Regulation* 63(2): 115–129.

Odneal, M. (2016). Sweet Potato Fasciation. https://blogs.missouristate.edu/fruitexperimentstation/2016/10/06/sweet-potato fasciation/. Accessed on 20 April 2022.

Shah, G.L. (1978). *Flora of Gujarat State (Part I and II)*. Sardar Patel University, Vallabh Vidyanagar, Anand, Gujarat.

White, O.E. (1948). Fasciation. *Botanical Review* 14(6): 319–358.

Wu, W., H. Cai, W. Wei, R.E. Davis, I.M. Lee, H. Chen & Y. Zhao (2011). Identification of two new phyllogenetically distant phytoplasmas from *Senna surattensis* plant exhibiting stem fasciation and shoot proliferarion symptoms. *Annals of Applied Biology* 160(1): 25–34.

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Invasion of *Volkameria inermis* L. in mangrove habitat of estuarine area of southern Gujarat: a future threat to mangrove species

Volkameria inermis L. belongs to Lamiaceae family which is a gregarious and bushy shrub species and mostly used as medicinal, ornamental, and home garden plants in India; but it has been observed frequently in coastal and estuary areas, therefore, various studies (Tomlinson 1986; Parani et al. 1998) considered it as semi mangrove, back mangrove or mangrove associate. This plant makes colonial growth due to floating of seeds in tidal water as a result of mass regeneration and establishment of population in the coastal as well as estuarine areas due to its high reproduction ability and prolific growth capability in new locations (Raju & Kumar 2016). A study done by Liang et al. (2022) described natural habitats of *V. inermis* are coast, beach, and tide with salt tolerant ability, while earlier study done by Biswas et al. (2018) described it as a native and terrestrial ornamental plants but now it has escaped in coastal areas,

A patch of *V. inermis* in Ambika Estuary area of Samapore Village, Navsari, Gujarat. © Rajkumar Yadav.

A patch of *V. inermis* in Ambika River Estuary area near Shikottar Mata temple, Jalalpor, Navsari, Gujarat. © Rajkumar Yadav.

estuarine areas, mangrove areas and therefore considered a potential invasive species for those areas.

Generally, plant invasion is defined as alien and exotic plant species occurring in non-native range due to some anthropogenic activities such as introduction or introduced accidentally (Richards & Friess 2015) and such kind of species have shown highest threat to biological diversity (Vitousek 1994; Yadav et al. 2020) and

it may create their communities because they are better competitors than resident native species (Leger & Espeland 2010). More or less, similar characteristics have been observed for *V. inermis* during a floristic study in estuarine areas of Purna and Ambika rivers in Navsari District of Gujarat where *V. inermis* has been frequently observed in estuarine areas of Samapore (20.9458° N & 72.7947° E) and nearby Sikkotar Mata temple (20.9336° N & 72.8131° E). These areas were found to be potential areas for various mangrove species such as *Avicennia marina* (Forssk.) Vierh., *Acanthus ilicifolius* L., *Sonneratia apetala* Banks, *Ceriops tagal* (Perr.) C.B. Rob., and *Bruguiera cylindrica* (L.). Bhatt et al. (2009) reported a total of seven mangrove species from Purna Estuary area.

In the study area, *V. inermis* was found to be healthy competitor in estuarine area by which all open potential mudflat areas have been densely covered. Moreover, a mangrove associate community, i.e., *Porteresia coarctata* (Roxb.) Tateoka, was also observed perpetually, but these plants are important constituents of mangrove plant succession along the estuaries of India (Jagat et al. 2006). Despite the competition for the growth of *V. inermis* in the estuarine areas of Purna and Ambika rivers in southern Gujarat, this species was found to be a potential invasive species, which may alter the growth and structure of mangrove species due to its high prolific growth and seed dispersal mechanism. The seeds of *V. inermis* may disperse due to various dispersal mechanism, in which, various vectors such as water, wind and coastal birds are involved (Biswas et al. 2018). However, mangrove species are more resilient to plant invasion in coastal areas because they grow into saline and intertidal environment where common terrestrial or fresh water plant species may struggle to survive or reproduce (Biswas et al. 2018). Nevertheless, mangrove habitats localizing in estuary (Purna and Ambika rivers) areas of southern Gujarat were found to be facing threats of some plant invasion which obstruct the growth of mangrove species. Estuarine areas are most productive, very dynamic areas which show dynamic nutrient and oxygen rich conditions and subsequently change the biota as per the high and low tides and salinity status of rivers. This ecosystem contains numerous micro habitats, i.e., mangrove, coastal grasslands, mudflats, which support the growth of halophytic and non-halophytic plant species.

In the current observation study, all open space of the estuarine areas especially landward side was occupied with enormous growth of *V. inermis* by which the growth of mangrove species was in stress and even new recruitments were found to be less than the mangrove recruitments found in coastal areas. Hence, during current observation, two locations, i.e., Samapore and nearby Sikkottar Mata temple of Purna and Ambika estuaries, respectively, were found to be dominated by *V. inermis*. The dominance of the species will be other than these areas as well, because it may expand its range beyond original noted sites due to its high prolific growth and fast spreading mechanisms.

Mangrove habitats in estuarine area are more sensitive for widespread growth of invasive species (Biswas et al. 2018) and it is considered as most threatened habitat in the world (Valiela et al. 2001) during reduced water and

soil salinity (Biswas et al. 2018). Scientifically, it is proved that *V. inermis* prefers reduced water and soil salinity for its healthier growth and the landward side of estuary areas are most favourable habitat for this plant due to upstream and downstream water connectivity. During current observation, dense patches of *V. inermis* were found in landward side in estuary area, hence, this observational study suggests that there is urgent need for structured monitoring of co-evolution of *V. inermis* in estuarine areas of Gujarat by mangrove conservators and managers so that future threats by it can be controlled earlier before it spreads in vast ranges in other areas of southern part of Gujarat.

References

Bhatt, S., D.G. Shah & N. Desai (2009). The mangrove diversity of Purna Estuary, south Gujarat, India. *Tropical Ecology* 50(2): 287–293.

Biswas, S.R., P.L. Biswas, S.H. Limon, E.R. Yan, M.S. Xu & M.I. Khan (2018). Plant invasion in mangrove forest worldwide. *Forest Ecology and Management* 429: 480–492.

Jagat, T.G., S. Bhoshale & C. Singh (2006). Characterization of *Porteresia coarctata* beds along the Goa coast, India. *Aquatic Botany* 84(1): 37–44.

Leger, E.A. & E.K. Espeland (2010). Coevolution between native and invasive plant competitors: implications for invasive species management. *Evolutionary Applications* 3: 169–178.

Liang, M., F. Hu, D. Xie , Z. Chen, Q. Zheng, Q. Xie, F. Zheng, D. Liu, S. Jian, H. Chen, X. Liu & F. Wang (2022). Physiological measurments and transciptoms surevey revealed how semi mangrove *Clerodendrum inerme* tolerates saline adversity. *Frontiers in Plant Science* 13: 1–14.

Parani, M., M. Lakshmi, P. Senthikkumar, R. Nivedita & A. Parida (1998). Molecular phylogeny of mangroves V. Analysis of genome relationships in mangrove species using RAPD and RFLP markers. *Theoretical and Applied Genetics* 97: 617–625.

Raju, A.J.S. & R. Kumar (2016). Pollination ecology of *Clerodendrum inerme* (L.) Geartn. (Lamiaceae) in Coringa mangrove ecosytem, Andhra Pradesh, India. *Journal of Threatened Taxa* 8(5): 8777–8787.

Richards, D.R. & D.A. Friess (2015). Rates of drivers of mangrove deforestation in southeast Asia, 2002–2012. *PNAS* 11 (2): 344–349.

Tomlinson, P.B. (1986). *The Botany of Mangroves.* Cambridge University Press, UK, 435 pp.

Valiela, I., J.L. Bowen & J.K. York (2001). Mangrove forests: One of the world's threatened major tropical environments. *Bioscience* 51(10): 807–815.

Vitousek, P.M. (1994). Beyond global warming: ecology and global change. *Ecology* 75(7): 1861–1876.

Yadav, R., A. Suthar, K. Tatu & R.D. Kamboj (2020). An invasive weed plant *Verbesina encelioides* (Cav.) Benth.- a future threat to herbaceous vegetation in dry areas of Gujarat. *Indian Forester* 146(4): 363–364.

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Opportunistic road count of Bearded Vulture in Himachal Pradesh

The Bearded Vulture *Gypaetus barbatus*, also called Lammergeier is well known as a mountain bird species. It is listed as a Near Threatened species by the IUCN (BirdLife International 2021). It is found in northern Africa, Europe, and in the Himalaya in Asia (Botha et al. 2017).

The bird is resident throughout the Himalayan range, being common in western part of the range (Naoroji 2006). Its nest and habitat are well described (Baker 1935) while the bird morphology and its behavior are also well described (Ali & Ripley 1983).

During January 2005, while conducting the *Gyps* vulture survey in Himachal Pradesh, I opportunistically recorded this graceful bird. Himachal Pradesh has 12 districts, but in this survey, the districts Lahaul and Spiti were not covered and Kinnaur was only partially covered because of heavy snowfall. In 10 districts, a total distance of 1,506 km was travelled along the highways in

Bearded Vulture in flight at Chail Wildlife Sanctuary, Himachal Pradesh. © Sachin Ranade.

21 days, sighting 10 Bearded Vultures at six locations in five districts (Table 1). For the state, the northernmost sighting was noted in Banikhet and Chamba districts while the southernmost observations were at Chail Wildlife Sanctuary, Solan District.

In all observations, the Bearded Vultures were seen following or loosely associated with the flock of Himalayan Vulture *Gyps himalayensis*. At Chail Wildlife Sanctuary, an immature and an adult individual were seen carrying bones collected from a carcass, dropping them on rocks from a height and feeding on them. At Dharamshala, a breeding pair was seen in the nest that was just next to the nesting colony of Himalayan Vulture. In the rest of the four instances, the birds were seen soaring along the bare hills and mountains.

A study with line transect distance sampling done for the species in Annapurna mountain range in Nepal had recorded an encounter rate of 0.21 vultures/km and density 0.184/km^{-2} (Subedi et al. 2018). The authors compared the

Table 1. Sighting records of Bearded Vulture in Himachal Pradesh in January 2005.

	Date	Time (H)	Village	District	Number	Activity	Latitude	Longitude	Altitude (m)
1	02.i.2005	1100	Kathed, Chail	Solan	2	Feeding on Bones	30.9403˚ N	77.2381˚ E	1439
2	14.i.2005	1520	Khaniara, Dharamshala	Kangra	2	On nest	32.2139˚ N	76.3944˚ E	1764
3	17.i.2005	1436	Bangala, Banikhet	Chamba	1	Soaring	32.5253˚ N	75.9367˚ E	1970
4	20.i.2005	1100	Jari	Kullu	1	Soaring	31.9731˚ N	77.2042˚ E	1284
5	21.i.2005	1200	Larji, Aut	Kullu	2	Soaring	NI	NI	NI
6	23.i.2005	1100	Rampur	Shimla	2	Soaring	31.4794˚ N	77.6897˚ E	898

NI - No Information.

population density to the Africa and Alps that appeared much low compared to the density in Nepal. The population of Bearded Vulture in Himalayas has breeding season from December to March (Ali & Ripley 1983). Hence, probably one or both the birds from the breeding pairs could be on nest and probably I came across fewer individuals with encounter rate 0.007 individuals per km.

In this survey, on only three occasions, pairs were observed. Interestingly, as an example of citizen science data, the species has been recorded globally 18,059 times—3,189 times from India, out of which 726 sightings in Himachal Pradesh recorded on the eBird (Orta et al. 2020) that underlines Himachal Pradesh's importance in the conservation of this relic species.

In comparison to the *Gyps* vultures, Bearded Vulture is solitary and due to its different food habit, it appears to be safe from the drug diclofenac. The species was locally extinct in Europe and Africa, and is being reintroduced successfully (Brink et al. 2020; Terraube et al. 2022). There is a need to investigate whether any such threat faces the Indian population of the Bearded Vulture.

References

Ali, S. & S.D. Ripley (1983). *Handbook of the Birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka. Compact ed*. Oxford University Press, Delhi, 737 pp.

Baker, E.C.S. (1935). *The nidification of birds of the Indian Empire. Vol IV*. Taylor and Francis, London, 546pp.

BirdLife International (2021). *Gypaetus barbatus*. The IUCN Red List of Threatened Species 2021: e.T22695174A166294930. https://doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695174A166294930.en

Botha, A.J., J. Andevski, C.G.R. Bowden, M. Gudka, R.J. Safford, J. Tavares & N.P. Williams (2017). *Multi-species Action Plan to Conserve African-Eurasian Vultures*. CMS Raptors MOU Technical Publication No. 5. CMS Technical Series No. 35. Coordinating Unit of the CMS Raptors MOU, Abu Dhabi, United Arab Emirates. 162pp.

Brink, C.W., S. Krüger & A. Amar (2020). Potential release sites and strategies for a Bearded Vulture *Gypaetus barbatus* reintroduction in South Africa. *Ostrich* 91(2):118–128.

Naoroji, R. (2006). *Birds of Prey of the Indian subcontinent*. Om Books International, New Delhi, 692 pp.

Orta, J., E. de Juana, J.S. Marks, C.J. Sharpe & E.F.J. Garcia (2020). Bearded Vulture *Gypaetus barbatus*, version 1.0. In: J. del Hoyo, A. Elliott, J. Sargatal, D.A. Christie & E. de Juana (Eds.). *Birds of the World*. Cornell Lab of Ornithology, Ithaca, NY, USA.

Subedi, T.R., M.Z. Virani, S. Gurung, R. Buij, H.S. Baral, E.R. Buechley, J.D. Anadón & S.A. Sah (2018). Estimation of population density of Bearded Vultures using line-transect distance sampling and identification of perceived threats in the Annapurna Himalaya range of Nepal. *Journal of Raptor Research* 52(4): 443-453.

Terraube, J., J. Andevski, F. Loercher & J. Tavares (2022). *Population estimates for the five European vulture species across the Mediterranean: 2022 update*. The Vulture Conservation Foundation, Koninklijke Burger's Zoo bv. Antoon van Hooffplein 1, 6816 SH Arnhem. Netherlands, 37 pp.

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Bird species richness trends in urban and semi-urban area in and around Pune City, India

Pune City located on the slopes of Western Ghats is one of the fastest growing cities in India along with rapid urbanization (Butsch et al. 2017). It is known to harbour a good biodiversity including 332 bird species (Ingalhalikar et al. 2000) but, has been negatively affected due to increased anthropogenic activities (Choudaj & Wankhede 2022).

(A) Tickell's Blue Flycatcher | (B) Indian Grey Hornbill | (C) Indian Spot-billed Duck | (D) Asian Green Bee-eater. © Christina Abraham.

To our knowledge, a specific comparative observational study on urban-semi urban areas isn't yet available for Pune City. Hence, the main objective of our study was to fill this gap, compare and contrast the species richness of birds observed in urban and semi-urban areas of Pune.

Two study sites were selected: a) Somwar Peth, Old Pune (18.5222° N & 73.8632° E) with very high degree of urbanization; and b) Pashan, Pune (18.5435° N & 73.7961° E) with relatively lower urbanization.

Data collection was done in early morning hours thrice a week from June 2021–January 2022 using a point count method. Identification of bird species was carried out using the Cornell Lab of Ornithology-Merlin's Bird Identification application (v. 2.0.1).

We calculated the Jaccard's similarity (djk = M / (M+N); 'M for the number of matches and N for the total number of columns with presence in just one row' – PAST manual: https://www.nhm.uio.no/english/research/resources/past/downloads/past4manual.pdf) between the two locations with the species data for a) total species and b) only terrestrial species. We used PAST (v 4.10) (Hammer et al. 2001) and Google Sheets for the analysis and visualisation.

Table 1 provide details of the species, families, and orders; abundance of families and species represented in both the sites. Similarity between the bird communities at both the sites based on the Jaccard's similarity was nearly 39% when all species were considered and 49% with only terrestrial species.

Our study documented nearly 50 species from just two locations within the Pune City limits with 23 species seen in

(A). Both the study sites situated 9 km away in Pune City | (B). Urban space in core Pune City (Somwar Peth): Study site 1 | (C). Semi-urban space in Pune City (Pashan): Study site 2.

A) Study site 1: Urban region © Eesha Chawan | (B) and (C) Study site 2: Semi-urban region © Christina Abraham.

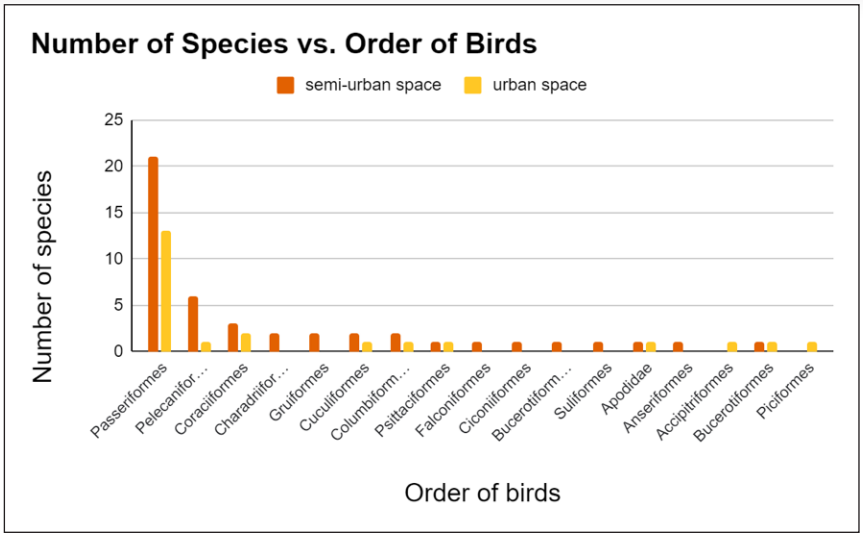
the heavily urbanised locality. This accounts for ~15% of the Pune bird fauna (Ingalhalikar et al. 2000). A very recent study showed the presence of 44 species of birds in two urban localities within the Pune metropolitan region (Choudaj & Wankhede 2022). Comparatively, our numbers were less for the urban site which could perhaps be due to sampling (regime, time period and/or method) difference. Bird richness was distinctly more at the semi urban site, though, four unique species to the urban site were also observed (Table 1).

An important factor in the unequal species richness could have been the presence of Pashan Lake close to our study site. Differences in vegetation could also have influenced the richness trends as variations in bird diversity are related to the vegetation changes in a region (Oduor 2013). Presence of exotic species of woody plants decreased the bird diversity in other urban locales in the Pune Metropolitan region (Choudaj & Wankhede 2022). We also observed invasive species like *Lantana camara* and *Parthenium hysterophorus* at the semi-urban site.

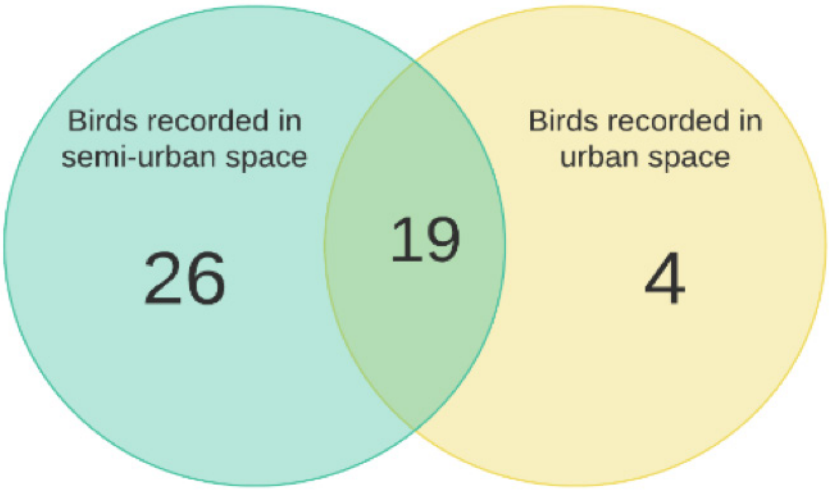
Table 1. Checklist of birds observed in urban and semi urban sites

Order	Family	Common name	Scientific name	Urban site	Semi-urban site	IUCN Red List status
Passeriformes	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	+	+	LC
		Red-whiskered Bulbul	*Pycnonotus jocosus* (Linnaeus, 1758)	+	+	LC
	Corvidae	House Crow	*Corvus splendens* Vieillot, 1817	+	+	LC
		Large-billed Crow	*Corvus macrorhynchos* Wagler, 1827	-	+	LC
		Rufous Treepie	*Dendrocitta vagabunda* (Latham, 1790)	-	+	LC
	Sturnidae	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	+	+	LC
		Jungle Myna	*Acridotheres fuscus* (Wagler, 1827)	-	+	LC
		Brahminy Starling	*Sturnia pagodarum* (Gmelin, 1789)	+	-	LC
	Dicruridae	Black Drongo	*Dicrurus macrocercus* Vieillot, 1817	+	+	LC
	Cisticolidae	Ashy Prinia	*Prinia socialis* Sykes, 1832	-	+	LC
		Common Tailorbird	*Orthotomus sutorius* (Pennant, 1769)	+	-	LC
Passeriformes	Campephagidae	White-bellied Minivet	*Pericrocotus erythropygius* (Jerdon, 1840)	-	+	LC
	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus* (Latham, 1790)	+	+	LC
		Purple-rumped Sunbird	*Leptocoma zeylonica* (Linnaeus, 1766)	+	+	LC
	Ploceidae	Baya Weaver	*Ploceus philippinus* (Linnaeus, 1766)	-	+	LC
	Muscicapidae	Tickell's Blue- Flycatcher	*Cyornis tickelliae* Blyth, 1843	-	+	LC
		Oriental Magpie-Robin	*Copsychus saularis* (Linnaeus, 1758)	+	+	LC
	Paridae	Cinereous Tit	*Parus cinereus* Vieillot, 1818	+	+	LC
	Rhipiduridae	Spot-breasted Fantail	*Rhipidura albogularis* (Lesson, 1831)	+	+	LC
	Dicaeidae	Thick-billed Flowerpecker	*Dicaeum agile* (Tickell, 1833)	-	+	LC
		Blyth's Reed-Warbler	*Acrocephalus dumetorum* Blyth, 1849	-	+	LC
	Aegithinidae	Common Iora	*Aegithina tiphia* (Linnaeus, 1758)	-	+	LC
	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata* (Linnaeus, 1758)	+	+	LC
Pelecaniformes	Ardeidae	Grey Heron	*Ardea cinerea* Linnaeus, 1758	-	+	LC

Order	Family	Common name	Scientific name	Urban site	Semi-urban site	IUCN Red List status
Pelecaniformes	Ardeidae	Intermediate Egret	*Ardea intermedia* Wagler, 1829	-	+	LC
		Cattle Egret	*Bubulcus ibis* (Linnaeus, 1758)	+	+	LC
		Indian Pond-Heron	*Ardeola grayii* (Sykes, 1832)	-	+	LC
	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus* (Latham, 1790)	-	+	NT
		Eurasian Spoonbill	*Platalea leucorodia* Linnaeus, 1758	-	+	LC
Gruiformes	Rallidae	Grey-headed Swamphen	*Porphyrio poliocephalus* (Latham, 1802)	-	+	LC
		White-breasted Waterhen	*Amaurornis phoenicurus* (Pennant, 1769)	-	+	LC
Coraciiformes	Meropidae	Asian Green Bee-eater	*Merops orientalis* Latham, 1802	+	+	LC
	Alcedinidae	White-throated Kingfisher	*Halcyon smyrnensis* (Linnaeus, 1758)	+	+	LC
		Common Kingfisher	*Alcedo atthis* (Linnaeus, 1758)	-	+	LC
Charadriiformes	Charadriidae	Red-wattled Lapwing	*Vanellus indicus* (Boddaert, 1783)	-	+	LC
	Laridae	River Tern	*Sterna aurantia* Gray, 1831	-	+	VU
Anseriformes	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha* Forster, 1781	-	+	LC
Bucerotiformes	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris* (Scopoli, 1786)	+	+	LC
Suliformes	Phalacrocoracidae	Little Cormorant	*Microcarbo niger* (Vieillot, 1817)	-	+	LC
Cuculiformes	Cuculidae	Asian Koel	*Eudynamys scolopaceus* (Linnaeus, 1758)	+	+	LC
		Greater Coucal	*Centropus sinensis* (Stephens, 1815)	-	+	LC
Ciconiiformes	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus* (Boddaert, 1783)	-	+	NT
Falconiformes	Falconidae	Common Kestrel	*Falco tinnunculus* Linnaeus, 1758	-	+	LC
Columbiformes	Columbidae	Laughing Dove	*Spilopelia senegalensis* (Linnaeus, 1766)	-	+	LC
		Rock Pigeon	*Columba livia* Gmelin, 1789	+	+	LC
Psittaciformes	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri* (Scopoli, 1769)	+	+	LC
Piciformes	Megalaimidae	Coppersmith Barbet	*Psilopogon haemacephalus* (Müller, 1776)	+	-	LC
Apodiformes	Apodidae	Little Swift	*Apus affinis* (Gray, 1830)	+	+	LC
Accipitriformes	Accipitridae	Black Kite	*Milvus migrans* (Boddaert, 1783)	+	-	LC



Number of Species vs Order of Birds.



Venn diagram showing the Beta diversity relationship between the study sites.

Ours was a small survey-based study primarily carried out to explore the differences in avifauna between urban and semi-urban regions.

Still, we feel it is critical to provide such baseline faunal information from urban centres like Pune as unplanned urbanization is a pertinent issue in the Indian context.

References

Butsch, C., S. Kumar, P. Wagner, M. Kroll, L. Kantakumar, E. Bharucha, K. Schneider & F. Kraa (2017). Growing 'Smart'? Urbanization processes in the Pune urban agglomeration. *Sustainability* 9(12): 2335.

Choudaj, K. & V. Wankhade (2022). Study of the interrelationship between woody plants and birds in Pune urban area, insights on negative impacts of exotic plants. *Tropical Ecology*, 1-12. https://doi.org/10.1007/s42965-022-00269-3

Hammer, O., D.A.T. Harper & P.D. Ryan (2001). PAST: Paleontological Statistics Software Package for education and data analysis. *Paleontología Electrónica* 4(1): 1–9.

Ingalhalikar, S., R. Purandare, S. Nalavade & S. Dhole (2000). Bird diversity changes of Pune urban area. *Journal of Ecological Society* 13(14): 59–70.

Oduor, A.M.O. (2013). Evolutionary responses of native plant species to invasive plants: a review. *New Phytologist* 200: 986–992.

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First photographic record of Chinese Pond-Heron from Bhitarkanika National Park, Odisha

Bhitarkanika National Park is situated on the east coast of India, in the state of Odisha between 20.5508°–20.7842° N & 86.8009°–87.0508° E. The area is a highly productive ecosystem and has significant biodiversity. It is well-known for the river deltas of Brahmani and Baitarani which bring abundant alluvial deposits, helping create India's second-largest mangrove forest.

Chinese Pond-Heron *Ardeola bacchus* in breeding plumage captured by camera trap in Bhitarkanika National Park, Odisha.

Mangrove vegetation, rivers, estuaries, mudflats, and aquatic bodies are the primary habitat types in this region. Research on the avian diversity of Bhitarkanika is scarce and limited.

An initial checklist of the birds of Bhitarkanika was created in the early 1990s (Gopi & Pandav 2007). In 1997, the first checklist of birds from Bhitarkanika reported 169 species (Pandav 1996) followed by other checklists with 263 species (Gopi & Pandav 2007) and 264 species (Venkatraman et al. 2016) in next two decades.

The grid-wise population estimation of the Fishing Cat *Prionailurus viverrinus* was conducted in Bhitarkanika National Park of Rajnagar Range, Odisha. During this survey, photographs of the Chinese Pond-Heron were captured in camera trap (Browning Strike Force Pro XD Trail camera) on 15, 16, and 19 June 2022. The camera traps were installed at a height of about 2.5 ft above the ground near a pond (20.6305° N & 86.8693° E) inside the mangrove area created by the forest department for the management practice of wildlife. The Chinese Pond-Heron was an adult male roaming around the pond for food. After the Chinese Pond-Heron was captured by the camera trap, literature review revealed that this might be the first photographic record of the species from the Bhitarkanika National Park.

The identification of the Chinese Pond-Heron is always confused with the Indian Pond-Heron and Javan Pond-Heron. The Chinese Pond-Heron is identified in the breeding season by its dark back and red chestnut head and neck. Adult Indian Pond-Heron has a distinctive creamy grey head,

throat, and breast. The head has long white plumes, the neck is creamy, and the mantle and scapulars are reddish-brown. In breeding plumage, adult Javan Pond-Heron has a pale brownish head and neck with white head plumes, a deep caramel breast, a white belly, and a blackish mantle and scapulars.

The Chinese Pond-Heron breeds in Russia, China, the Korean peninsula, Japan, northern Myanmar, northeastern India, and the Andaman Islands in winter (Kushlan & Hancock 2005; Rasmussen & Anderton 2005). It has also been recorded as a vagrant in Sri Lanka and coastal southeastern Bangladesh (Ali & Ripley 1987; Hoffmann 1996). The species had been recorded before in various states of India like Manipur (Ali & Ripley 1987), Gujarat (Parasharya 1983), Arunachal Pradesh (Singh 1995), Assam (Choudhury 2008), Tamil Nadu (Kaninde 2013), Rajasthan (Poonia et al. 2013), and also in Narcondam Island, Andaman, and Nicobar Islands (Gokulakrishnan et al. 2020).

The sightings of Chinese Pond-Herons in breeding plumage in Gujarat, Rajasthan, and Tamil Nadu show that the species may be easily ignored or overlooked, especially in non-breeding plumage, given its remarkable similarity with the common Indian Pond-Heron *Ardeola grayii* (Khan et al. 2015). The present study confirmed the first scientific observation with photographic record of Chinese Pond-Herons for the state of Odisha. However, the species had been sighted from Nalabana, Chilika by group of bird watchers during 2006. After that, the species has not been observed elsewhere in Odisha (Shri Hrudananda Jena, pers. comm., a trained bird watcher of Chilika Wildlife Division, Govt. of Odisha). Current study concluded that the total number of bird species is 265 in the Bhitarkanika National Park. As it is considered extant (resident) in India, further research is required to study the possible occurrence of the species in different parts of Odisha for its conservation.

References

Ali, S. & S.D. Ripley (1987). *Handbook of the Birds of India and Pakistan, together with those of Bangladesh, Nepal, Bhutan, and Sri Lanka*. Oxford University Press, Delhi, 261 pp

Choudhury, A. (2008). Recent sightings of Chinese Pond-Heron *Ardeola bacchus* in Assam. *Indian BIRDS* 5(6): 185.

Gokulakrishnan, G., C. Sivaperuman & D. Meena (2020). Birds of Narcondam Island, Andaman and Nicobar Islands with an updated checklist. *Journal of the Andaman Science Association* 25(1): 50–69.

Gopi, G.V. & B. Pandav (2007). Avifauna of Bhitarkanika mangroves, India. *Zoos' Print Journal* 22(10): 2839–2847.

Hoffmann, T.W. (1996). New bird records in Sri Lanka and some connected matters. *Journal of the Bombay Natural History Society* 93(3): 382–388.

Kaninde, S. (2013). Sighting of Chinese Pond Heron *Ardeola bacchus* from Chennai, Tamil Nadu, India. *Indian BIRDS* 8(6):158.

Khan, B., E. Hussain, T. Mundkur, S. Abbas & G. Khan (2015). Chinese Pond Heron *Ardeola bacchus*: an addition to the avifauna of Pakistan. *Birding Asia* 24: 136–137.

Kushlan, J.A. & J.A. Hancock (2005). *The Herons*. Oxford: Oxford University Press, 456 pp.

Pandav, B. (1996). Birds of Bhitarkanika mangroves, eastern India. *Forktail* 12: 9–20.

Parasharya, B.M. (1983). An erithristic pond heron. *Pavo* 21(1&2): 107–108.

Poonia, S.S., M. Sharma & H.S. Sangha (2013). Chinese Pond Heron *Ardeola bacchus* in Rajasthan, India. *Indian BIRDS* 8(6): 159–160.

Rasmussen, P.C. & J.C. Anderton (2005). *Birds of South Asia: the Ripley guide*. First edition. Smithsonian Institution & Lynx Edicions, Washington DC & Barcelona, 2 vols. 378 pp & 683 pp.

Singh, P. (1995). Recent bird records from Arunachal Pradesh, India. *Forktail* 10: 65–104.

Venkatraman, C., P. Padmanaban, S. Shrinivaasu & G. Sivaleela (2016). Faunal diversity of Bhitarkanika mangroves, Odisha. *Records of the Zoological Survey of India* 116(part 4): 407–430.

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Checklist of avifauna from sewage treatment plant, Mayiladuthurai District, Tamil Nadu

Wetlands are considered as the important bird habitats as the birds depend on them for feeding, roosting and breeding (Vijayan et al. 2006). Several natural wetlands around the world have been lost owing to manmade activities, thus birds have been depending on man-made artificial wetlands such as agricultural lands, abandoned aquaculture ponds, and salt-pans as alternative foraging and resting grounds.

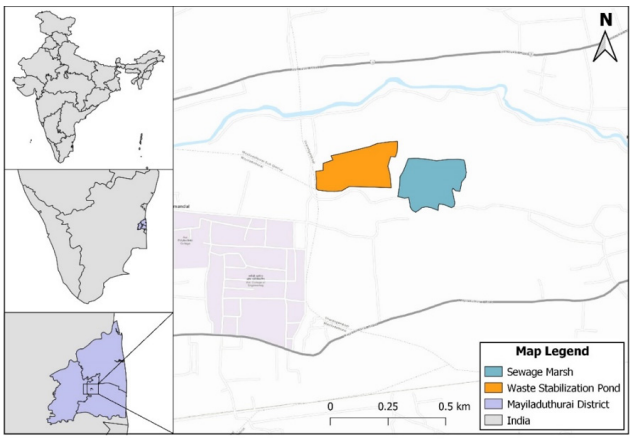
Sewage treatment plants (STPs) are characterised by a variety of habitats ranging from wetlands to manmade waste stabilisation ponds with open mudflats to grasslands, dry sites and places that are frequently flooded by wastewater (Orłowski 2013). Therefore, investigating bird population characteristics can be utilized to design a suitable management plan for the conservation of one or a group of bird species in a particular habitat. This is the first study to document the avifauna in the sewage treatment plant from Tamil Nadu, India.

The study site is located in Mannampandal (11.1094603 N, 79.6953181 E), Mayiladuthurai District, Tamil Nadu. This area is used as a waste stabilization pond to treat sewage from the Mayiladuthurai District. Tamil Nadu Water Supply and Drainage Board of Mayiladuthurai manage this area.

Systematic bird surveys were carried out in all the microhabitats of the study area from September 2018 to March 2020. The observations were made mostly during the evening hours (1600–1800 h) and a few instances in the mornings (0600–0800 h). The total count was used to count the birds (Wetlands International 2010). The birds were observed using Nikon Aculon (8x42) binoculars and photographed using Nikon P900 point and shoot digital camera for the references. The birds were identified using the characteristic features (Grimmett et al. 2011). We followed (Praveen & Jayapal 2022) for the taxonomic classification of birds.

The avian diversity at the STP was represented by 107 species belonging to 51 families and 19 orders and the family dominance is provided in Table 2.

Among the bird species recorded, four species namely Black-headed Ibis *Threskiornis melanocephalus*, Black-tailed Godwit *Limosa limosa*, Painted Stork *Mycteria leucocephala*,



Map showing Sewage Treatment Plant, Mannampandal, Tamil Nadu, southern India and different habitats.

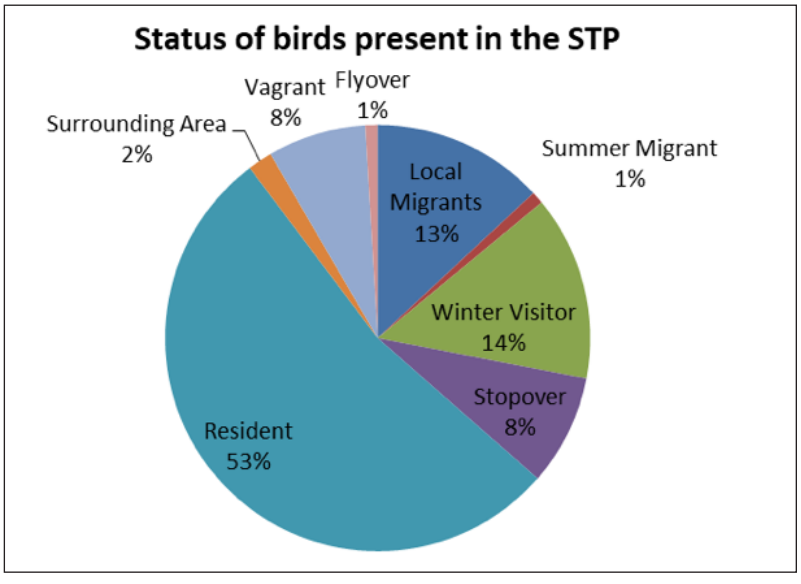
Table 1. Checklist of birds found in sewage treatment plant, Mayiladuthurai District, Tamil Nadu.

	Order	Family	English name	Scientific name	IUCN Red List	Status to STP
1	Anseriformes	Anatidae	Lesser Whistling Duck	*Dendrocygna javanica*	LC	LM
2			Garganey	*Spatula querquedula*	LC	SO
3			Northern Shoveler	*Spatula clypeata*	LC	SO
4	Galliformes	Phasianidae	Indian Peafowl	*Pavo cristatus*	LC	R
5			Grey Francolin	*Francolinus pondicerianus*	LC	R
6	Podicipediformes	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	LM
7	Columbiformes	Columbidae	Rock Pigeon	*Columba livia*	LC	R
8			Eurasian Collared-Dove	*Streptopelia decaocto*	LC	R
9			Spotted Dove	*Streptopelia chinensis*	LC	R
10	Cuculiformes	Cuculidae	Greater Coucal	*Centropus sinensis*	LC	R
11			Blue-faced Malkoha	*Phaenicophaeus viridirostris*	LC	R
12			Pied Cuckoo	*Clamator jacobinus*	LC	LM
13			Asian Koel	*Eudynamys scolopaceus*	LC	R
14			Grey-bellied Cuckoo	*Cacomantis passerinus*	LC	LM
15			Common Hawk Cuckoo	*Hierococcyx varius*	LC	R
16	Caprimulgiformes	Apodidae	Asian Palm Swift	*Cypsiurus balasiensis*	LC	R
17	Gruiformes	Rallidae	Common Moorhen	*Gallinula chloropus*	LC	R
18			Eurasian Coot	*Fulica atra*	LC	SM
19			Grey-headed Swamphen	*Porphyrio poliocephalus*	LC	LM
20			Watercock	*Gallicrex cinerea*	LC	Va
21			White-breasted Waterhen	*Amaurornis phoenicurus*	LC	R
22	Charadriiformes	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	WV
23		Charadriidae	Yellow-wattled Lapwing	*Vanellus malabaricus*	LC	Va
24			Grey-headed Lapwing	*Vanellus cinereus*	LC	WV
25			Red-wattled Lapwing	*Vanellus indicus*	LC	R
26			Little Ringed Plover	*Charadrius dubius*	LC	SO
27		Rostratulidae	Greater Painted-snipe	*Rostratula benghalensis*	LC	R
28		Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	LM
29		Scolopacidae	Black-tailed Godwit	*Limosa limosa*	NT	SO
30			Ruff	*Calidris pugnax*	LC	SO
31			Little Stint	*Calidris minuta*	LC	SO
32			Pintail Snipe	*Gallinago stenura*	LC	WV
33			Common Sandpiper	*Actitis hypoleucos*	LC	WV
34			Green Sandpiper	*Tringa ochropus*	LC	WV
35			Marsh Sandpiper	*Tringa stagnatilis*	LC	WV
36			Wood Sandpiper	*Tringa glareola*	LC	WV
37		Laridae	Gull-billed Tern	*Gelochelidon nilotica*	LC	SO
38	Ciconiiformes	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	SA
39			Painted Stork	*Mycteria leucocephala*	NT	FO
40	Suliformes	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	Va
41	Pelecaniformes	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC	R
42			Grey Heron	*Ardea cinerea*	LC	Va

	Order	Family	English name	Scientific name	IUCN Red List	Status to STP
43	Pelecaniformes	Ardeidae	Purple Heron	*Ardea purpurea*	LC	Va
44			Great Egret	*Ardea alba*	LC	LM
45			Little Egret	*Egretta garzetta*	LC	LM
46			Cattle Egret	*Bubulcus ibis*	LC	LM
47			Indian Pond Heron	*Ardeola grayii*	LC	LM
48			Black-crowned Night-Heron	*Nycticorax nycticorax*	LC	Va
49		Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	LC	WV
50			Black-headed Ibis	*Threskiornis melanocephalus*	NT	Va
51	Accipitriformes	Accipitridae	Shikra	*Accipiter badius*	LC	R
52			Black Kite	*Milvus migrans*	LC	LM
53			Brahminy Kite	*Haliastur indus*	LC	R
54	Strigiformes	Tytonidae	Common Barn Owl	*Tyto alba*	LC	R
55		Strigidae	Indian Scops Owl	*Otus bakkamoena*	LC	R
56			Spotted Owlet	*Athene brama*	LC	R
57	Bucerotiformes	Upupidae	Common Hoopoe	*Upupa epops*	LC	R
58	Coraciiformes	Alcedinidae	Common Kingfisher	*Alcedo atthis*	LC	R
59			White-throated Kingfisher	*Halcyon smyrnensis*	LC	R
60			Pied Kingfisher	*Ceryle rudis*	LC	R
61		Meropidae	Green Bee-eater	*Merops orientalis*	LC	R
62		Coraciidae	Indian Roller	*Coracias benghalensis*	LC	R
63	Piciformes	Megalaimidae	Coppersmith Barbet	*Psilopogon haemacephalus*	LC	R
64		Picidae	Black-rumped Flameback	*Dinopium benghalense*	LC	R
65	Falconiformes	Falconidae	Red-necked Falcon	*Falco chicquera*	NT	Va
66	Psittaciformes	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	LC	R
67	Passeriformes	Pittidae	Indian Pitta	*Pitta brachyura*	LC	SO
68		Oriolidae	Indian Golden Oriole	*Oriolus kundoo*	LC	LM
69		Artamidae	Ashy Woodswallow	*Artamus fuscus*	LC	R
70		Vangidae	Common Woodshrike	*Tephrodornis pondicerianus*	LC	R
71		Dicruridae	Black Drongo	*Dicrurus macrocercus*	LC	R
72		Monarchidae	Indian Paradise-flycatcher	*Terpsiphone paradisi*	LC	LM
73		Laniidae	Brown Shrike	*Lanius cristatus*	LC	WV
74		Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	LC	R
75			House Crow	*Corvus splendens*	LC	R
76			Large-billed Crow	*Corvus macrorhynchos*	LC	R
77		Alaudidae	Jerdon's Bushlark	*Mirafra affinis*	LC	R
78		Cisticolidae	Common Tailorbird	*Orthotomus sutorius*	LC	R
79			Ashy Prinia	*Prinia socialis*	LC	R
80			Plain Prinia	*Prinia inornata*	LC	R
81		Acrocephalidae	Booted Warbler	*Iduna caligata*	LC	WV
82			Clamorous Reed Warbler	*Acrocephalus stentoreus*	LC	WV
83		Hirundinidae	Barn Swallow	*Hirundo rustica*	LC	WV
84			Wire-tailed Swallow	*Hirundo smithii*	LC	WV

	Order	Family	English name	Scientific name	IUCN Red List	Status to STP
85	Passeriformes	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	LC	R
86			White-browed Bulbul	*Pycnonotus luteolus*	LC	R
87		Leiothrichidae	Yellow-billed Babbler	*Argya affinis*	LC	R
88		Sturnidae	Rosy Starling	*Pastor roseus*	LC	WV
89			Brahminy Starling	*Sturnia pagodarum*	LC	R
90			Common Myna	*Acridotheres tristis*	LC	R
91		Turdidae	Orange-headed Thrush	*Geokichla citrina*	LC	SO
92		Muscicapidae	Indian Robin	*Copsychus fulicatus*	LC	R
93			Oriental Magpie- Robin	*Copsychus saularis*	LC	R
94			Pied Bushchat	*Saxicola caprata*	LC	R
95		Dicaeidae	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*	LC	R
96		Nectariniidae	Purple-rumped Sunbird	*Leptocoma zeylonica*	LC	R
97			Purple Sunbird	*Cinnyris asiaticus*	LC	R
98			Loten's Sunbird	*Cinnyris lotenius*	LC	R
99		Ploceidae	Streaked Weaver	*Ploceus manyar*	LC	R
100			Baya Weaver	*Ploceus philippinus*	LC	R
101		Estrildidae	White-rumped Munia	*Lonchura striata*	LC	R
102			Scaly-breasted Munia	*Lonchura punctulata*	LC	R
103			Tricoloured Munia	*Lonchura malacca*	LC	R
104		Passeridae	Yellow-throated Sparrow	*Gymnoris xanthocollis*	LC	R
105		Motacillidae	Western Yellow Wagtail	*Motacilla flava*	LC	WV
106			White-browed Wagtail	*Motacilla maderaspatensis*	LC	R
107			Paddyfield Pipit	*Anthus rufulus*	LC	R

IUCN Category: LC—Least Concern | NT—Near Threatened | Status to STP: R—Resident | SO—Stop Over | WV—Winter Visitor | SM—Summer Migrant | FO—Fly Over | LM—Local Migrant | Va—Vagrant | SA—Surrounding Area.



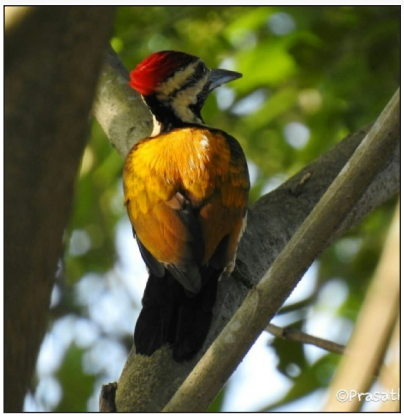
Status of bird species recorded at sewage treatment plant of Mayiladuthurai District, Tamil Nadu.

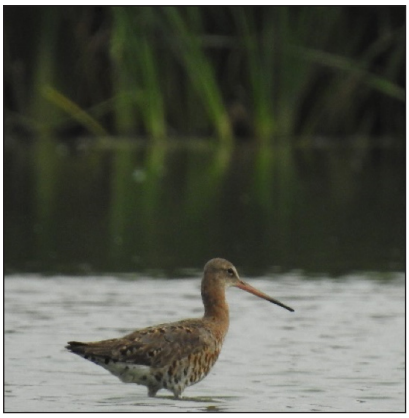
and Red-necked Falcon *Falco chicquera* were listed under 'Near Threatened' and remaining 103 bird species were 'Least Concern' of the IUCN Red List. Based on the occurrence data, about 53% were found to be resident followed by winter visitors (14%) and local migrants (13%). The checklist of birds inhabiting in STP is enlisted in the Table 1.

Birds recorded from sewage treatement plant, Mayiladuthurai District, Tamil Nadu


Asian Openbill.


Black Drongo.


Black-rumped Flameback.


Black-tailed Godwit.


Blue-faced Malkoha.


Brahminy Kite.


Cinnamon Bittern.


Common Hawk-Cuckoo.

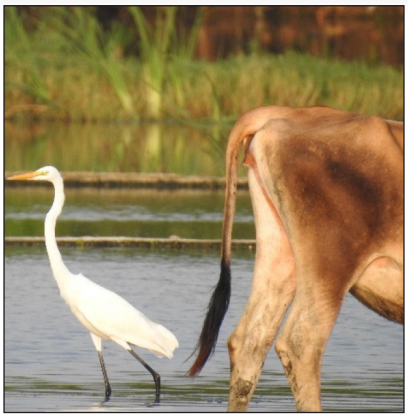

Common Hoopoe.

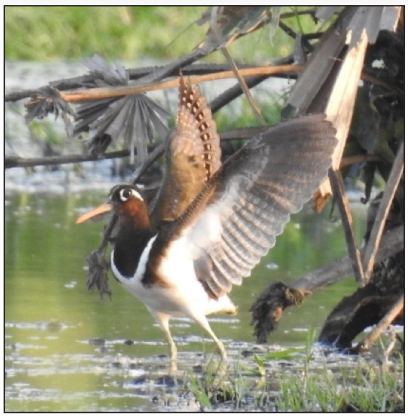

Common Kingfisher.


Common Moorhen.

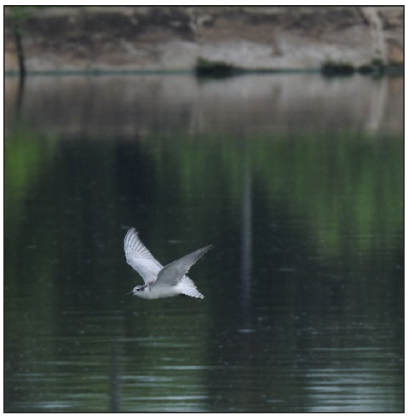

Eurasian Collard-Dove.


Garganey.


Great Egret.


Greater Painted-Snipe.


Green Bee-eater.

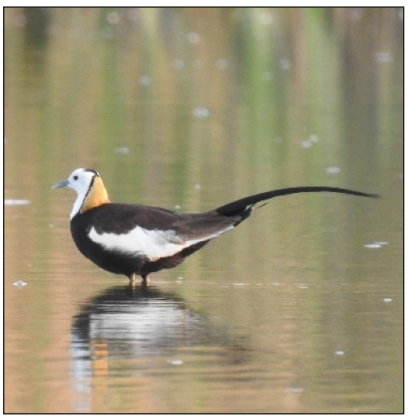

Gull-billed Tern.


Lesser Whistling-Duck.


Little Grebe.


Northern Shoveler.


Orange-headed Thrush.


Pheasant-tailed Jacana.


Pied Kingfisher.


Pintail Snipe.


Shikra.


Streaked Weaver.


Watercock.


Western Yellow Wagtail.


White-throated Kingfisher.


Wire-taild Swallow.


Wood Sandpiper.


Yellow-throatd Sparrow.

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Out of 107 species, 38 species were classified as waterbirds belonging to six orders and 13 families. Of the 38 species, 16 species are listed as regular wintering migrants to India under the CAF (Central Asian Flyway) National Action Plan 2018, India in which two species namely, Black-tailed Godwit and Little Stint are listed under the species shortlisted for the preparation of Single Species Action Plan. The birds found breeding in the STP were Greater Painted-Snipe *Rostratula benghalensis*, White-breasted Waterhen *Amaurornis phoenicurus*, Common Moorhen *Gallinula chloropus*, Red-wattled Lapwing *Vanellus indicus*, Baya Weaver *Ploceus philippinus*, Streaked Weaver *Ploceus manyar*, Spotted Dove *Streptopelia chinensis*, Black Drongo *Dicrurus macrocercus*, and Purple Sunbird *Cinnyris asiaticus*.

Table 2. Order-wise (family and species) avian diversity at sewage treatment plant, Mayiladuthurai

	Order	No. of family	No. of species
1	Passeriformes	23	41
2	Charadriiformes	6	16
3	Coraciiformes	3	5
4	Pelecaniformes	2	10
5	Strigiformes	2	3
6	Piciformes	2	2
7	Galliformes	1	2
8	Anseriformes	1	3
9	Podicipediformes	1	1
10	Columbiformes	1	3
11	Caprimulgiformes	1	1
12	Cuculiformes	1	6
13	Gruiformes	1	5
14	Ciconiiformes	1	2
15	Suliformes	1	1
16	Accipitriformes	1	3
17	Bucerotiformes	1	1
18	Falconiformes	1	1
19	Psittaciformes	1	1
	Total	**51**	**107**

Ecological studies of birds in the Mayiladuthurai District of Tamil Nadu are scarce. The present observation was the first study to assess the avian diversity in the STP of the district.

Earlier study by Ali et al. (2011) in the Mayiladuthurai region recorded 75 species of birds of which 11 species belonged to waterbirds. This study indicates that this area is having diverse avifauna and also this habitat is used by different species of birds for wintering and stopover during migratory season.

The usage of artificial wetlands, including waste stabilization ponds (WSPs), by waterbirds in the current scenario is typically opportunistic but little consideration has been given by managers of WSPs to the potential implications for either wastewater treatment or waterbird conservation objectives (Murray et al. 2014). Hence, we suggest that it is important to conserve these artificial wetlands for the survival of the birds in future.

References

Ali, A.M.S., S. Asokan, R. Manikannan & P. Radhakrishnan (2011). Checklist and nesting patterns of avifauna in and around Mayiladuthurai region, Tamil Nadu, India. *Journal of Threatened Taxa* 3(6):1842–1850.
Grimmett, R., C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent*. 2nd ed. Oxford University Press & Christopher Helm, London, 528 pp.
Murray, C.G., S. Kasel, E. Szantyr, R. Barratt & A.J. Hamilton (2014). Waterbird use of different treatment stages in waste-stabilisation pond systems. *Emu* 114(1): 30–40.
Orłowski, G. (2013). Factors affecting the use of waste-stabilization ponds by birds: A case study of conservation implications of a sewage farm in Europe. *Ecological Engineering* 61 436–445.
Praveen, J. & R. Jayapal (2022). Checklist of the birds of India (v6.2). Website: http://www.indianbirds.in/india/. Accessed on 21 February 2023.
Vijayan, L., S.N. Prasad, N. Sridharan & B.M. Guptha (2006). Status of wetlands and wetland birds in selected districts of Tamil Nadu. Salim Ali Centre for Ornithology and Natural History. Technical Report 35, 68 pp.
Wetlands International (2010). Guidance on waterbird monitoring methodology: Field Protocol for waterbird counting, 15 pp.

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