

The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

# Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

# **SHORT COMMUNICATION**

# IMPACT OF VEHICULAR TRAFFIC ON BIRDS IN TIRUCHIRAPPALLI DISTRICT, TAMIL NADU, INDIA

T. Siva & P. Neelanarayanan

26 July 2020 | Vol. 12 | No. 10 | Pages: 16352–16356 DOI: 10.11609/jott.5532.12.10.16352-16356





For Focus, Scope, Aims, Policies, and Guidelines visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0 For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2 For reprints, contact <ravi@threatenedtaxa.org>

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Publisher & Host



Member



ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

DOI: https://doi.org/10.11609/jott.5532.12.10.16352-16356

#5532 | Received 06 November 2019 | Final received 22 May 2020 | Finally accepted 30 June 2020



# Impact of vehicular traffic on birds in Tiruchirappalli District, Tamil Nadu, India

T. Siva <sup>1</sup> & P. Neelanarayanan <sup>2</sup>

<sup>1,2</sup> Research Department of Zoology, Nehru Memorial College (Autonomous & Affiliated to Bharathidasan University), Puthanampatti, Tiruchirappalli District, Tamil Nadu 621007, India. <sup>1</sup> sivanaturewild@gmail.com (corresponding author), <sup>2</sup> dr.pnn31@gmail.com

Abstract: Roads have numerous direct and indirect ecological impacts on wildlife. Roads constitute an extensive and integral part of our environment. Collisions with vehicles kill a large number of birds every year. The present study was carried out from January 2016 to December 2016. The data was collected from Nehru Memorial College to Pavithram Lake of Thuraiyur to Namakkal road of Musiri Taluk, Tiruchchirappalli District. During this study, we recorded a total of 64 birds belonging to 12 species killed due to vehicular traffic. A maximum of 11 birds were killed in the months of January and October, and a minimum of two bird kills were observed in the months of September and December. Of the 64 birds, the roadside mortality was observed to the tune of 25%, 20.3%, 14%, 12.5%, 10.9%, 4.6%, and 4.6% for Southern Coucal Centropus parroti, Common Myna Acridotheres tristis. House Crow Corvus splendens. Spotted Owlet Athene brama, Indian Jungle Crow Corvus culminatus, Yellowbilled Babbler Turdoides affinis, and Large Grey Babbler Turdoides malcolmi. Other birds such as Asian Koel Eudynamys scolopaceus, Indian Roller Coracias benghalensis, Shikra Accipiter badius, Whitebreasted Waterhen Amaurornis phoenicurus, and White-browed Bulbul Pycnonotus luteolus accounted for 1.5% mortality. Suggestive measures to prevent wildlife loss due to vehicular traffic are presented in this communication.

Keywords: Bird mortality, Common Myna, ecological factors, roadkill, vehicle collision.

Roads are important part of human life for moving from one place to another with the help of vehicles. They restrict animal movement within the landscape and they cause roadside animal mortality due to vehicles (Van der Zande et al. 1980; Forman & Alexander 1998). Roads affect the surrounding environment in many ways to harm their neighboring floral and faunal diversity (Forman & Alexander 1998). Roads can alter animal behavior, with many animals being attracted to them (Santos et al. 2011). For example, ectothermic animals like reptiles visit roads to bask, and birds consume fallen grains from roadside and gravel to aid digestion (Noss 2002). Scavenging birds like corvids and raptors are attracted to the carcasses of other roadkill animals and are often killed themselves (Dean & Milton 2003; Antworth et al. 2005; Collinson 2013).

(00)

Road accidents with vehicles lead to death or injury of several groups of animals from small insects to large mammals all over the world. They affect the populations of both common and threatened animal species. Birds utilize roads for foraging, hunting, scavenging, shelter and this can increase their vulnerability to vehicle collisions (Orlowski 2005; Boves 2007; Huijser et al. 2007). Insectivorous and nocturnal birds follow insects that are attracted to headlights of vehicles during the night making them more vulnerable to collisions.

Most of the roadkill studies on wildlife have been taken up in protected areas and particularly on large mammals.

Editor: V. Gokula, National College, Trichy, India.

Date of publication: 26 July 2020 (online & print)

Citation: Siva.T. & P. Neelanarayanan (2020). Impact of vehicular traffic on birds in Tiruchirappalli District, Tamil Nadu, India. Journal of Threatened Taxa 12(10): 16352-16356. https://doi.org/10.11609/jott.5532.12.10.16352-16356

Copyright: © Siva & Neelanaravanan 2020. Creative Commons Attribution 4.0 International License. JOTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

Funding: None.

**Competing interests:** The authors declare no competing interests.



Acknowledgements: We are highly indebted to the Management and Principal of Nehru Memorial College (Autonomous) for their help and encouragement. We thank Mr. G. Lakshmanan for his help during the study period.

### Impact of vehicular traffic on birds

In India, roadkill mortality studies outside protected areas are scarce, a few have been reported by Kumara et al. (2000), Vijayakumar et al. (2001), Sunder (2004), Pragatheesh (2011), Seshadri & Ganesh (2011), and Gubbi et al. (2012). According to Sundar (2004), during wet monsoon season, more number of bird mortality is recorded on the roads compared to the other seasons. These studies underline the importance of understanding how road characteristics and road surroundings influence roadkill numbers and hence the present investigation.

## MATERIALS AND METHODS Study Area

The study area was selected between Nehru Memorial College and Pavithram Lake of Musiri Taluk (State Highway numbers 62 and 161 between Thuraiyur and Namakkal) (Figure 1). This is one of the busiest routes of this area and it is used commonly by two-wheelers, cars, public transport buses, and goods carriers of various sizes. The length of the road was 41km. The altitude of the chosen study area ranged 110–225 m. On the 41-km road stretch on either side, the following habitats of mostly rainfed crop lands, barren lands, human habitations, and a few forest areas were observed.

### Methods

The present study was carried from January 2016 to December 2016. Roadkill surveys were conducted using a two-wheeler. Only birds killed due to vehicular traffic were observed and recorded approximately 10 to 15 days every month. Data on the roadkill species, number of individuals and the place of the kill was noted, and the latitude and longitude recorded using a hand-held Garmin etrax20 device; however, roadkill specimens were not collected from the encountered sites and only photographs were taken to aid in identification. The killed birds were identified up to species level using the field guide by Grimmett et al. (2011).

### **RESULTS AND DISCUSSION**

In total, 64 birds were encountered and recorded during the entire study period (Table 1; Image 1–8). There were 12 species of birds which belonged to six orders (Cuculiformes, Passeriformes, Coraciiformes, Accipitriformes, Strigiformes, and Gruiformes) and nine families (Cuculidae, Sturnidae, Corvidae, Coraciidae, Leiothrichidae, Accipitridae, Strigidae, Rallidae, and Pycnonotidae). In the months of January and October, a maximum of 11 dead birds were observed. On the other



Figure 1. The chosen study area where bird roadkills due to vehicular traffic were encountered.

hand, a minimum of two birds were seen in the months of September and December 2016 (Figure 2). Highest mortality in terms of numbers, i.e., 16 were found for Southern Coucal *Centropus parroti* followed by 13 for Common Myna *Acridotheres tristis*, nine for House Crow *Corvus splendens*, eight for Spotted Owlet *Athene brama*, seven for Indian Jungle Crow *Corvus culminatus*, three for Yellow-billed Babbler *Turdoides affinis* and Large Grey Babbler *Turdoides malcolmi*, and one each for Asian Koel *Eudynamys scolopaceus*, Indian Roller *Coracias benghalensis*, Shikra *Accipiter badius*, White-breasted Waterhen *Amaurornis phoenicurus*, & White-browed Bulbul *Pycnonotus luteolus*.

Maximum mortality (30) was recorded close to Devarappampatti and the adjacent forest areas (Devarappampatti Reserved Forest). As there are only three speed breakers in the stretch between Kannanurpalayam and Thathaiyangarpettai, vehicles cross this distance at high speeds. The commuters traveling on two and four-wheelers near the forest areas throw food including food grains on either side of the road, which attract birds and eventually lead to the mortality of birds. More number of bird mortality in the months of January and October might be correlated with the movement of general public in their own and public vehicles before and after local festivals such as 'Pongal' and 'Diwali'. During these months the vehicular traffic density would be more when compared to all other months in the year and this would have caused a higher number of bird roadkills. Among the recorded birds, there were nine omnivorous, two carnivorous, and one insectivorous bird. Scavengers or omnivorous birds were attracted to carcasses on the roads, and while feeding on them, were hit by vehicles resulting in their death. All the 12 species of recorded birds are common and are listed in the Least Concern category of IUCN but their role in the environment is essential.

The highest mortality of Southern Coucals in the present investigation is due to their habit of low height flight (1–2 m above the road; pers. obs. of first author) when crossing the road. Similarly, babblers also took low height flight while crossing the road. Common Myna has the habit of searching scattered grains and other



Figure 2. Month-wise bird mortality observed and recorded in the study area.

	Order	Family	Name of the bird	Scientific name	Food habit	Number of bird roadkills
1	Accipitriformes	Accipitridae	Shikra	Accipiter badius	Carnivorous	1
2	Gruiformes	Rallidae	White-breasted Waterhen	Amaurornis phoenicurus	Omnivorous	1
3	Cuculiformes	Cuculidae	Asian Koel	Eudynamys scolopaceus	Omnivorous	1
4			Southern Coucal	Centropus (sinensis) parroti	Omnivorous	16
5	Strigiformes	Strigidae	Spotted Owlet	Athene brama	Carnivorous	8
6	Coraciiformes	Coraciidae	Indian Roller	Coracias benghalensis	Insectivores	1
7	Passeriformes	Corvidae	House Crow	Corvus splendens	Omnivorous	9
8			Indian Jungle Crow	Corvus (macrorhynchos) culminatus	Omnivorous	7
9		Leiothrichidae	Yellow-billed Babbler	Turdoides affinis	Omnivorous	3
10			Large Grey Babbler	Turdoides malcolmi	Omnivorous	3
11		Pycnonotidae	White-browed Bulbul	Pycnonotus luteolus	Omnivorous	1
12		Sturnidae	Common Myna	Acridotheres tristis	Omnivorous	13
Total						64

Table 1. Birds that were killed due to vehicular traffic in the chosen study area during the study period.

Impact of vehicular traffic on birds



Image 1–8. Birds killed due to vehicle collisions during the study period. 1—House Crow | 2—White-breasted Waterhen | 3—Southern Coucal | 4—Common Myna | 5—Large Grey Babbler | 6—Yellow-billed Babbler | 7—Spotted Owlet | 8—Shikra. © T. Siva.

food particles on and alongside the road. Thus, it can be suggested that the common factors for the mortality of birds is the movement from one side to another side at low height, and getting attracted towards food on the road or along the road sides.

Roadkill studies in India has mainly focused on vertebrates with a few studies on invertebrates. Earlier, in Anamalai Hills, Vijayakumar et al. (2001) reported roadkill of vertebrate fauna such as amphibians, reptiles, birds, and mammals while Jeganathan et al. (2018) reported both invertebrate and vertebrate animals' mortality. Wildlife mortality due to vehicular traffic in Mudumalai Wildlife Sanctuary and Tiger Reserve has been published by Gokula (1997) and Baskaran & Boominathan (2010). Roadkill of amphibians was earlier recorded by Seshadri et al. (2009) from the Sharavathi River basin in central Western Ghats. Roadkill mortality of snakes in the Malnad region, central Western Ghats, was given by Jagadeesh et al. (2014). Earlier researchers reported the following factors to affect bird mortality on roads such as the volume of traffic, speed of vehicles, scavenging behaviour, individual configuration of roads, road density, foraging opportunities (Clevenger et al. 2003; Erritzoe et al. 2003; Holm & Laursen 2011; Kociolek & Clevenger 2011). All these factors corroborate the results of the present investigation. This study presents observations made in non-protected areas.

### **CONCLUSIONS AND RECOMMENDATIONS**

It is evident from the results that the chosen study area is prone to bird roadkills due to vehicular traffic. Movement of birds from one side to the other side of the road at low height and feeding on food grains/carcasses found on or near the road could be the major reasons for the roadkill. Awareness about the importance of birds needs to be created among the drivers of vehicles who frequently/regularly use the road.

### REFERENCES

- Antworth, R.L., D.A. Pike & E.E. Stevens (2005). Hit and run: effects of scavenging on estimates of road-killed vertebrates. *Southeastern Naturalist* 4: 647–656.
- Baskaran, N & D. Boominathan (2010). Road kill of animals by highway traffic in the tropical forests of Mudumalai Tiger Reserve, southern India. *Journal of Threatened Taxa* 2(3): 753–759. https://doi. org/10.11609/JoTT.o2101.753-9
- Boves, T. (2007). The effects of roadway mortality on Barn Owls in Southern Idaho and a study of ornamentation in North America Barn Owls. Master's Thesis. Boise State University, Idaho, USA. 108pp.
- Clevenger, A.P., C. Bryan & K.E. Gunscon (2003). Spatial patterns and factors influencing small vertebrate fauna roadkill aggregations. *Biological Conservation* 109: 15–26. https://doi.org/10.1016/S0006-3207(02)00127-1
- Collinson, W.J. (2013). A standardized protocol for roadkill detection and the determinants of roadkill in the Greater Mapungubwe

Transfrontier Conservation Area, Limpopo province, South Africa. MSc Thesis, Rhodes University, Grahamstown.

- Das, A., M.F. Ahmed, B.P. Lahkar & P. Sharma (2007). A preliminary report of reptilian mortality on road due to vehicular movement near Kaziranga National Park, Assam, India. *Zoos' Print Journal* 22(7): 2742–2744. https://doi.org/10.11609/JoTT.ZPJ.1541.2742-4
- Dean, W.R.J & S. Milton (2003). The importance of roads and road verges for raptors and crows in the Succulent and Nama-Karoo, South Africa. Ostrich 74: 181–186.
- Erritzoe, J., T. Mazgajski & L. Rejt (2003). Bird casualties on European roads–a review. Acta Ornithologica 38: 77–93. https://doi. org/10.3161/068.038.0204
- Forman, R.T. & L.E. Alexander (1998). Roads and their major ecological effects. *Annual Review of Ecological Systems* 29: 207–231.
- Gokula, V. (1997). Impact of vehicular traffic on snakes in Mudumalai Wildlife Sanctuary. *Cobra* 27: 26.
- Grimmett, R., C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Princeton University Press, India, 528pp.
- Gubbi, S., H.C. Poornesha & M.D. Madhusudan (2012). Impact of vehicular traffic on large mammal use of highway-edges in southern India. *Current Science* 102: 1047–1051.
- Holm, T.E. & K. Laursen (2011). Car traffic along hedgerows affects breeding success of Great Tits Parus major. Bird Study 58: 512–515.
- Huijser, M.P., J. Fuller, M.E. Wagner, A. Hardy & A.P. Clevenger (2007). Animal vehicle collision data collection. A synthesis of highway practice. NCHRP Synthesis 370. Project 20-05/Topic 37-12. Transportation Research Board of the National Academies, Washington DC, 108pp.
- Jeganathan, P., D. Mudappa., M.A. Kumar & T.R.S. Raman (2018). Seasonal variation in wildlife roadkills in plantations and tropical rainforest in the Anamalai Hills, Western Ghats, India. *Current Science* 114(3): 619–626.
- Kociolek, A.V & T.P. Clevenger (2011). Effects of road networks on bird populations. *Conservation Biology* 25: 241–249.
- Kumara, H.N., A.K. Sharma, M.A. Kumar & M. Singh (2000). Road kills of wild fauna in Indira Gandhi Wildlife Sanctuary, Western Ghats, India: implications for management. *Biosphere Conservation* 3: 41–47.
- Noss, R. (2002). The ecological effects of roads. http://www.eco action. org/dt/roads.html.
- Orlowski, G. (2005). Factors affecting road mortality of Barn Swallow Hirundo rustica in farmland. Acta Ornithologica 40: 117–125. https:// doi.org/10.3161/068.040.0207
- Pragatheesh, A. (2011). Effect of human feeding on the road mortality of Rhesus Macaques on National Highway-7 routed along Pench Tiger Reserve, Madhya Pradesh, India. *Journal of Threatened Taxa* 3(4): 1656–1662. https://doi.org/10.11609/JoTT.o2669.1656-62
- Santos, S.M., F. Carvalho & A. Mira (2011). How long do the dead survive on the road? Carcass persistence probability and implications for road-kill monitoring surveys. *PLOS ONE*. 6: 1–12.
- Seshadri, K.S. & T. Ganesh (2011). Faunal mortality on roads due to religious tourism across time and space in protected areas: a case study from south India. *Forest Ecology and Management* 262: 1713– 1721.
- Seshadri, K.S., A. Yadev & K.V. Gururaja (2009). Road kills of amphibians in different land use areas from Sharavathi river basin, central Western Ghats India. *Journal of Threatened Taxa* 1(11): 549–552. https://doi.org/10.11609/JoTT.o2148.549-52
- Sundar, K.S.G. (2004). Mortality of herpetofauna, birds and mammals due to vehicular traffic in Etawah District, Uttar Pradesh, India. *Journal of the Bombay Natural History Society* 101: 392–398.
- Van der Zande, A.N., W.J.T. Aeurs & W.J. Van der Weijden (1980). The impact of roads on the densities of four bird species in an open field habitat-evidence for a long distance effect. *Biological Conservation* 18: 299–321.
- Vijayakumar, S.P., K. Vasudevan & N.M. Ishwar (2001). Herpetofaunal mortality on roads in the Anamalai Hills, southern Western Ghats. *Hamadryad* 26: 265–272.







The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

## ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

July 2020 | Vol. 12 | No. 10 | Pages: 16195–16406 Date of Publication: 26 July 2020 (Online & Print) DOI: 10.11609/jott.2020.12.10.16195-16406

#### **Short Communications**

A threat assessment of Three-striped Palm Squirrel *Funambulus palmarum* (Mammalia: Rodentia: Sciuridae) from roadkills in Sigur Plateau, Mudumalai Tiger Reserve, Tamil Nadu, India

 Arockianathan Samson, Balasundaram Ramakrishnan & Jabamalainathan Leonaprincy, Pp. 16347–16351

Impact of vehicular traffic on birds in Tiruchirappalli District, Tamil Nadu, India – T. Siva & P. Neelanarayanan, Pp. 16352–16356

# Ichthyofaunal diversity of Manjeera Reservoir, Manjeera Wildlife Sanctuary, Telangana, India

- Kante Krishna Prasad, Mohammad Younus & Chelmala Srinivasulu, Pp. 16357-16367

New distribution record of the endemic and critically endangered Giant Staghorn Fern *Platycerium grande* (Fee) Kunze (Polypodiaceae) in central Mindanao – Cherie Cano-Mangaoang & Charissa Joy Arroyo Gumban, Pp. 16368–16372

#### Notes

First photographic record of the Dhole *Cuon alpinus* (Mammalia: Carnivora: Canidae) from the Sirumalai Hills in Tamil Nadu, India

- B.M. Krishnakumar & M. Eric Ramanujam, Pp. 16373-16376

Tracing heavy metals in urban ecosystems through the study of bat guano

- a preliminary study from Kerala, India

- Jithin Johnson & Moncey Vincent, Pp. 16377-16379

Population dynamics and management strategies for the invasive African Catfish Clarias gariepinus (Burchell, 1822) in the Western Ghats hotspot – Kuttanelloor Roshni, Chelapurath Radhakrishnan Renjithkumar, Rajeev Raghavan, Neelesh Dahanukar & Kutty Ranjeet, Pp. 16380–16384

# First records of the black widow spider *Latrodectus elegans* Thorell, 1898 (Araneae: Theridiidae) from Nepal

- Binu Shrestha & Tobias Dörr, Pp. 16385-16388

First report of the assassin bug *Epidaus wangi* (Heteroptera: Reduviidae: Harpactorinae) from India

- Swapnil S. Boyane & Hemant V. Ghate, Pp. 16389-16391

Observations of the damselfly *Platylestes* cf. *platystylus* Rambur, 1842 (Insecta: Odonata: Zygoptera: Lestidae) from peninsular India – K.J. Rison & A. Vivek Chandran, Pp. 16392–16395

Herminium longilobatum (Orchidaceae), a new record for Bhutan – Ugyen Dechen, Tandin Wangchuk & Lam Norbu, Pp. 16396–16398

# Recent record of a threatened holoparasitic plant Sapria himalayana Griff. in

Mehao Wildlife Sanctuary, Arunachal Pradesh, India – Arif Ahmad, Amit Kumar, Gopal Singh Rawat & G.V. Gopi , Pp. 16399–16401

Eleven new records of lichens to the state of Kerala, India

– Sonia Anna Zachariah, Sanjeeva Nayaka, Siljo Joseph, Pooja Gupta & Scaria Kadookunnel Varghese, Pp. 16402–16406

## www.threatenedtaxa.org

### Editorial

Pakshirajan Lakshminarasimhan: a plant taxonomist who loved plants and people alike – Mandar N. Datar, Pp. 16195–16203

#### Communications

The worrisome conservation status of ecosystems within the distribution range of the Spectacled Bear Tremarctos ornatus (Mammalia: Carnivora: Ursidae) in Ecuador – José Guerrero-Casado & Ramón H. Zambrano, Pp. 16204–16209

Living with Leopard *Panthera pardus fusca* (Mammalia: Carnivora: Felidae): livestock depredation and community perception in Kalakkad-Mundanthurai Tiger Reserve, southern Western Ghats

 Bawa Mothilal Krishnakumar, Rajarathinavelu Nagarajan & Kanagaraj Muthamizh Selvan, Pp. 16210–16218

### An updated checklist of mammals of Odisha, India

- Subrat Debata & Himanshu Shekhar Palei, Pp. 16219-16229

Negative human-wildlife interactions in traditional agroforestry systems in Assam, India – Yashmita-Ulman, Manoj Singh, Awadhesh Kumar & Madhubala Sharma, Pp. 16230–16238

Prevalence and morphotype diversity of *Trichuris* species and other soil-transmitted helminths in captive non-human primates in northern Nigeria – Joshua Kamani, James P. Yidawi, Aliyu Sada, Emmanuel G. Msheliza & Usman A. Turaki,

 - Joshua Kamani, James F. Tudawi, Anyu Saud, Emmanuer G. Ivisneliza & Usman A. Turaki, Pp. 16239–16244

### Detection of hemoparasites in bats, Bangladesh

– Shariful Islam, Rakib Uddin Ahmed, Md. Kaisar Rahman, Jinnat Ferdous, Md. Helal Uddin, Sazeda Akter, Abdullah Al Faruq, Mohammad Mahmudul Hassan, Ausraful Islam & Ariful Islam, Pp. 16245–16250

Ecology of the Critically Endangered Singidia Tilapia (Teleostei: Cichlidae: *Oreochromis* esculentus) of lake Kayanja, Uganda and its conservation implications

 – Richard Olwa, Herbert Nakiyende, Elias Muhumuza, Samuel Bassa, Anthony Taabu-Munyaho & Winnie Nkalubo, Pp. 16251–16256

#### Length-weight relationships of two conservation-concern mahseers (Teleostei: Cyprinidae: Tor) of the river Cauvery, Karnataka, India

– Adrian C. Pinder, Rajeev Raghavan, Shannon D. Bower & J. Robert Britton, Pp. 16257–16261

The identity and distribution of *Bhavania annandalei* Hora, 1920 (Cypriniformes: Balitoridae), a hillstream loach endemic to the Western Ghats of India

 Remya L. Sundar, V.K. Anoop, Arya Sidharthan, Neelesh Dahanukar & Rajeev Raghavan, Pp. 16262–16271

# Records of two toads *Duttaphrynus scaber* and *D. stomaticus* (Amphibia: Anura: Bufonidae) from southeastern India

– S.R. Ganesh, M. Rameshwaran, Naveen A. Joseph, Ahamed M. Jerith & Sushil K. Dutta, Pp. 16272–16278

## Some rare damselflies and dragonflies (Odonata: Zygoptera and Anisoptera) in Ukraine: new records, notes on distribution, and habitat preferences

- Alexander V. Martynov, Pp. 16279-16294

## Floristic diversity of Anjaneri Hills, Maharashtra, India

– Sanjay Gajanan Auti, Sharad Suresh Kambale, Kumar Vinod Chhotupuri Gosavi & Arun Nivrutti Chandore, Pp. 16295–16313

# A checklist of macrofungi (mushroom) diversity and distribution in the forests of Tripura, India

— Sanjit Debnath, Ramesh Chandra Upadhyay, Rahul Saha, Koushik Majumdar, Panna Das & Ajay Krishna Saha, Pp. 16314–16346



Member





