A checklist of fish and shellfishes of the Poonthura estuary, southwestern coast of India

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Abstract: A systematic checklist of fish and shellfishes of the Poonthura estuary, Kerala, India is provided including notes on their conservation status. This checklist includes 66 finfish and five shellfish, belonging to 17 orders, 35 families, and 60 genera. Carangiformes is the richest order (11 species, eight genera, and three families), representing 15.4% of the total fish diversity. Carangidae, is the most diverse family with nine representatives, contributing to 12.6% of the total fish diversity. Following the IUCN Red List Categories, of the total 69 species (excluding both exotic and transplanted fish species), 59 belong to the ‘Least Concern’, while one species Pampus argenteus is listed as ‘Vulnerable’, four are ‘Data Deficient’ (Megalops cyprinoides, Arius maculatus, Cynoglossus semifasciatus, and Epinephelus tauvina) and five are ‘Not Evaluated’ (Nuchequulia blochii, Channa pseudomarulius, Penaeus indicus, P monodon, and Scylla serrato). Around 94% of the recorded fish fauna have commercial value and contribute to subsistence fisheries throughout the year. Taxonomy and diversity of fish fauna of least studied or isolated estuarine ecosystems should be updated with proper documentation of their conservation status, in order to design and implement pragmatic management and conservation programs.

Keywords: Brackish water, fish diversity, Ichthyofauna, Kerala estuaries.
INTRODUCTION

Estuaries are transitional zones between sea and freshwater that are inhabited by both inland and marine species, including their juvenile stages (McLusky & Elliott 2006; Elliott et al. 2007; Franco et al. 2008; Potter et al. 2010; Sreekanth et al. 2018). Compared to marine or freshwater systems, estuaries are variable, complicated, and stressful habitats (Selleslagh & Amara 2008; Human et al. 2016; Kiranya et al. 2022). Many commercially important fish species benefit from the highly productive nature of estuaries as their nursery area (Harrison & Kelly 2013). Therefore, much emphasis is required to protect estuarine environments so as to ensure the growth and survival of commercially important fish and shellfish species (Elliott et al. 2007).

The estuaries, backwaters, coastal creeks and large brackishwater systems contribute to a significant part of fish production in India (Nair et al. 1983; Tudu et al. 2018). The peculiarity of Indian estuaries is that they are characterized by high species diversity with low numerical abundance (Sreekanth et al. 2019). Poonthura Estuary situated in the Thiruvananthapuram district of Kerala is comparatively small and shallow, and is formed due to the formation of a sand bar near the estuarine mouth (Kiranya et al. 2018). Previous authors who worked on this estuary have reported its ecological degradation mainly due to indiscriminate fishing and pollution from point and non-point sources (Kiranya et al. 2018).

In Kerala, considerable number of studies have dealt with taxonomic entities within estuarine systems, i.e., species composition, species distribution, and abundance, and spatial and temporal variations in fish diversity (Bijukumar & Sushama 2000; Harikrishnan et al. 2011; Regi & Bijukumar 2012; Kiranya et al. 2018; Roshni et al. 2021; Kiranya et al. 2022), with many such studies concentrated on a single estuary, the Vembanad Lake (Kurup & Samuel 1987; Menon et al. 2000; Harikrishnan et al. 2011; Roshni et al. 2021). There is considerable knowledge gap on the fish diversity and distribution patterns in many estuaries of Kerala, notably in the case of smaller systems such as Poonthura estuary, because of their isolated nature (Kiranya et al. 2018, 2022). Considering this lacuna, the present study focuses on presenting a comprehensive checklist of fish and shellfish species of Poonthura estuary, along with their systematic position, and conservation status (according to the IUCN Red List). The increasing availability of data on estuarine fish and shellfish fauna will facilitate their use in greater detail to design and implement pragmatic strategies and programs for estuarine fisheries management and conservation.

MATERIALS AND METHODS

Study area

The Poonthura Estuary (0.9 km² long and 0.1 km wide) is one of the most ecologically significant, and at the same time a polluted estuary in Thiruvananthapuram, Kerala (Kiranya et al. 2022). The estuary is micro-tidal and partially mixed, with an average tidal range of 1.5 m, and separated from the Lakshadweep Sea by a sand bar at Poonthura. The sand bar opens during the monsoon due to heavy discharge of water from the River Karamana. During heavy river discharge and land drainage during the monsoon, the sand bar between sea and estuary is either naturally, or manually opened. Artificial breaching of the estuary is also a frequent practice in this area to avoid flooding into nearby human settlements (Kiranya et al. 2018). The Poonthura estuary has also been undergoing severe ecological degradation with its bottom being muddy with a pungent smell, due to the unmanaged disposal of municipal sewage, land drainage, and industrial effluents (Kiranya et al. 2018). Full-time, part time and migrant fishers of 200 families of the adjoining areas belonging to the traditional sector depend on this estuary both directly and indirectly for subsistence, almost throughout the year (Kiranya et al. 2018).

Sampling and analysis

The present study was carried out in multiple phases from June 2016 to October 2020. Three sampling stations were fixed based on the fishing activity, tidal influx, and drainage from rivers/land. Monthly samples of fish and shellfish were collected from the selected stations (Image 1). Sampling was performed during early morning using 110 m surface and bottom set gillnets (mesh size 30 mm) and 4.5 m cast net (mesh size 8 mm) (one sampling each using both bottom set gillnets, surface gill net and cast net at a sampling station) operated from a small plank-built canoe (3 m LOA). Identification of fish and shellfishes were done at the species level by using published keys (Jayaram 1981; Fischer & Bianchi 1984). Identification of Channa pseudomarulius followed Britz et al. (2017). Taxonomic status and systematic position of fishes follow the Catalog of Fishes (Fricke et al. 2021) and World Register of Marine Species database (WoRMS 2021). Vernacular and local names of fish and shellfish species were collected from the traditional fishers.
through questionnaires. The conservation status of fish species is based on the IUCN Red List of Threatened Species (IUCN 2021). Voucher specimens and photo vouchers (of those species whose specimens were not collected) are deposited in the Department of Fisheries Resource Management, Kerala University of Fisheries and Ocean Studies, Kochi, Kerala, India.

**RESULTS AND DISCUSSION**

Total of 71 species (66 finfish and five shellfishes) within 17 orders and 35 families and 60 genera were recorded from Poonthura estuary (Table 1) (Image 2a–g). The dominant fish orders recorded were Carangiformes (15.4%) with 11 species followed by orders Clupeiformes (14%), Perciformes (11.2%), Mugiliformes (7.04%), Cypriniformes (7.04%), and members of the crustacean order Decapoda (7.04%) (Figure 2). Comparable results were recorded by Regi & Bijukumar (2012), who observed that Perciformes, Siluriformes, Clupeiformes, and Mugiliformes, were the most common taxonomic orders in the Veli-Akkulam backwaters which is the adjacent backwater system (13 km away from Poonthura estuary) and shares similar characteristics with Poonthura estuary such as small size, isolated, and temporarily closed nature.

The dominant finfish families recorded in Poonthura estuary (Figure 3) were Carangidae with nine species (12.6%), Clupeidae with six species, Mugilidae and Cyprinidae with five species each (7.04%), and Leiognathidae and Ambassidae with four species (5.6%). The major species within family Carangidae were *Atule mate*, *Caranx ignobilis*, *Alepes djedaba*, and *Trachinotus blochii*.

Species such as *Etroplus suratensis*, *Oreochromis mossambicus*, *Gerres filamentosus*, *Chelon parsia*, *Mugil cephalus*, *Arius arius*, and *Caranx ignobilis* represented the most common species of the estuarine system, with *Etroplus suratensis* and *Oreochromis mossambicus* being recorded throughout the year during the study period. The present study also revealed the occurrence of two fish species having ornamental value, the filament barb, *Dawkinsia filamentosa* and the silver moony,
Monodactylus argenteus.

Of the four species of shrimps/prawns recorded from the estuary, *Penaeus indicus* was the dominant species followed by *P. monodon* and *Macrobrachium rosenbergii*. The mud crab *Scylla serrata* was the only representative of crabs that was observed in the local catches.

Based on the IUCN Red List of Threatened Species, of the 69 species recorded (excluding exotic and translocated species) from Poonthura Estuary, 85.7% (59 species) were under the ‘Least Concern’ category, one species was under the ‘Vulnerable’ category (*Pampus argenteus*), four species under the ‘Data Deficient’ (Megalops cyprinoides, *Arius maculatus*, Cynoglossus semifasciatus, and *Epinephelus tauvina*) and five under the ‘Not Evaluated’ (*Nuchequula blochii*, *Channa pseudomarulius*, *Penaeus indicus*, *P. monodon*, and *Scylla serrata*) categories (Figure 3).

Several authors have studied estuarine fish diversity of west flowing river systems in Kerala, most of them pointing at the predominance of finfish species. Bijukumar & Sushama (2000) presented an overview of the ichthyofauna of the Ponnani estuary representing 112 finfish species belonging to 14 orders, 53 families, and 80 genera. Kurup & Samuel (1987) recorded 150 species of fishes from Vembanad lake, while a recent study by Roshni et al. (2021) reported 90 species of fish belonging to 17 orders and 40 families suggesting a 40% reduction in fish fauna since 1980s. Raj et al. (2014) reported 68 species of finfishes, five species of crabs, nine species of prawns from the Ashtamudi estuary, and stated that pearlspot and mullets supported good local fisheries. From Chettuva estuary, Johny et al. (2016) recorded 68 species of fish belonging to 45 genera while the diversity of nearby Azhikode backwaters (Satheesan et al. 2014). Fifty species under 40 genera of finfishes were recorded from the Akathumuri backwaters (Harikrishnan et al. 2011). Fifty species under 40 genera of finfish were recorded from the Veli-Akkulam lake. According to the above authors, *O. mossambicus* has dominated the native fish species in many Indian water bodies due to its prolific breeding, voracious feeding habits, and hardy nature.
Table 1. Checklist of fish and shellfish recorded from Poonthura estuary, their taxonomic position, common and vernacular names, IUCN Red List status and voucher numbers.

| Order/Family/Species | Common name | Vernacular name | IUCN status | Voucher number |
|----------------------|-------------|-----------------|-------------|---------------|
| ORDER ELOPIFORMES    |             |                 |             |               |
| Elapidae (Ten pounders/Lady fishes) |             |                 |             |               |
| Elops machnata (Forsskål, 1775) | Ladyfish/ten pounder | Olivi meen | LC | Photo voucher |
| MEGALOPIDAE (Tarpons) |             |                 |             |               |
| Megalops cyprinoides Broussonet, 1782 | Indo-pacific tarpon | Kannamalavu | DD | KUFOS.FV.2019.1041 |
| ORDER CLupeiformes   |             |                 |             |               |
| Anodontostoma chacunda (Hamilton, 1822) | Shortnose gizzard shad | Noona | LC | KUFOS.FV.2019.1042 |
| Amblygaster sirm (Walbaum, 1792) | Spotted sardine | Keeri chaala | LC | KUFOS.FV.2019.1045 |
| Dayella malabarica (Day, 1873) | Day’s round herring | Kaly netholi | LC | KUFOS.FV.2016.1007 |
| Nematalosa nasus (Bloch, 1795) | Bloch’s gizzard shad | Kuthavu | LC | Photo voucher |
| Sardiniella albella (Bleeker, 1849) | White sardine | Chappa chaala | LC | KUFOS.FV.2019.1044 |
| Sardiniella gibbosa (Bleeker, 1849) | Goldstripe sardiniella | Mullan chaala | LC | KUFOS.FV.2019.1043 |
| ENGRAULIDAE (Anchovies) |             |                 |             |               |
| Encrasicholina devisi (Whitley, 1940) | Devi’s anchovy | Netholi | LC | KUFOS.FV.2019.1046 |
| Steinophorus indicus (Van Hasselt, 1823) | Indian anchovy | Vella Netholi | LC | KUFOS.FV.2019.1047 |
| Thryssa mystax (Bloch & Schneider, 1801) | Moustached anchovy | Mullan manangu | LC | Photo voucher |
| CHIROCENTRIDAE (Wolf herring) |             |                 |             |               |
| Chirocentrus dorab (Forskål, 1775) | Dorab wolf-herring | Mulluvaala | LC | KUFOS.FV.2017.1009 |
| ORDER CYPRINIFORMES  |             |                 |             |               |
| Amblypharyngodon microlepis (Bleeker, 1853) | Indian carplet | Vayambu | LC | KUFOS.FV.2020.1002 |
| Dawkinsia filamentosa (Valenciennes, 1844) | Filament barb | Kaly Paral | LC | KUFOS.FV.2020.1001 |
| Labeo caltus (Hamilton, 1822) | Catla | Katla | TR | KUFOS.FV.2019.1049 |
| Puntius parrah Day, 1865 | Parrah barb | Parrah barb | LC | KUFOS.FV.2019.1050 |
| Systomus sarana (Hamilton, 1822) | Olive barb | Kuruvu | LC | KUFOS.FV.2019.1048 |
| ORDER SILURIFORMES   |             |                 |             |               |
| Mystus armatus (Day, 1865) | Kerala mystus | Chilan thedu | LC | KUFOS.FV.2019.1051 |
| ARIIDAE (Sea catfishes) |             |                 |             |               |
| Arius arius (Hamilton, 1822) | Threadfin sea catfish | Theedu | LC | KUFOS.FV.2020.1003 |
| Arius maculatus (Thunberg, 1792) | Spotted catfish | Kadal thedu | DD | Photo voucher |
| HETEROPNEUSTIDAE (Stinging catfish) |             |                 |             |               |
| Heteropeucestus fossilis (Bloch, 1794) | Stinging catfish | Karuppan thedu | LC | KUFOS.FV.2020.1004 |
| ORDER BELONIFORMES   |             |                 |             |               |
| Xenentodon cancila (Hamilton, 1822) | Freshwater garfish | Chundu mural | LC | KUFOS.FV.2019.1052 |
| HEMIRAMPHIDAE (Half beaks) |             |                 |             |               |
| Hyporhamphus xantheropus (Valenciennes, 1847) | Valenciennes halfbeak | Kolaachi | LC | KUFOS.FV.2016.1001 |
| GOBIIDAE (Gobies) |             |                 |             |               |
| Glossogobius giuris (Hamilton, 1822) | Tank goby | Poonthi | LC | KUFOS.FV.2017.1001 |
| Order/Family/Species          | Common name                  | Vernacular name | IUCN status | Voucher number |
|------------------------------|------------------------------|-----------------|-------------|----------------|
| VII ORDER Incertae sedis under Ovalenteria | | | |
| 13 AMBASSIDAE (Asiatic glassfishes) | | | |
| Ambassis gymnocephalus (Lacepède, 1802) | Naked-head glassy perchlet | Mullu nandhan | LC | KUFOS.FV.2020.1007 |
| Parambassis dayi (Bleeker, 1874) | Day’s glassy perchlet | Nandhan | LC | KUFOS.FV.2020.1020 |
| Parambassis thomasi (Day, 1870) | Westernghat glassy perchlet | Nandhan | LC | KUFOS.FV.2020.1006 |
| VIII MUGILIFORMES | | | |
| 14 MUGILIDAE (Mullets) | | | |
| Chelon parsia (Hamilton, 1822) | Gold spot mullet | Kadam maalvu | LC | KUFOS.FV.2020.1008 |
| Crenimugil seheli (Fabricius, 1775) | Blue spot mullet | Parichal | LC | KUFOS.FV.2020.1002 |
| Mugil cephalus (Linnaeus, 1758) | Grey mullet | Maalavu | LC | KUFOS.FV.2019.1055 |
| Osteomugil perusi (Valenciennes, 1836) | Long finned mullet | Kadalapala | LC | KUFOS.FV.2019.1053 |
| Planiliza subviridis (Valenciennes, 1836) | Green black mullet | Kelayan | LC | KUFOS.FV.2019.1054 |
| IX CICHLIFORMES | | | |
| 15 CICHLIDAE (Cichlids) | | | |
| Etroplus suratensis (Bloch, 1790) | Banded pearl spot | Karimeen | LC | KUFOS.FV.2016.1003 |
| Oreochromis mossambicus (Peters, 1852) | Mozambique tilapia | Piloppi | EX | KUFOS.FV.2016.1002 |
| Pseudetroplus maculatus Bloch, 1795 | Orange chromide | Pallathi | LC | KUFOS.FV.2020.1009 |
| X ORDER CARANGIFORMES | | | |
| 16 CARANGIDAE (Jacks and Pompanos) | | | |
| Alepes djedaba (Forsskál, 1775) | Shrimp scad | Thovi paara | LC | KUFOS.FV.2017.1011 |
| Alepes vari (Cuvier, 1833) | Herring scad | Thali paara | LC | KUFOS.FV.2020.1022 |
| Atule mate (Cuvier, 1833) | Yellowtail scad | Manjaval paara | LC | KUFOS.FV.2016.1008 |
| Caranx heberi (Bennett, 1830) | Blacktip trevally | Karuppuvaval paara | LC | KUFOS.FV.2020.1023 |
| Caranx hippos (Linnaeus, 1766) | Common jack | Neelan paara | LC | KUFOS.FV.2016.1007 |
| Caranx ignobilis (Forsskál, 1775) | Yellowfin trevally | Velaa paara | LC | KUFOS.FV.2016.1009 |
| Decapterus russell (Rüppell,1830) | Indian scad | Kannan kozhiyala | LC | KUFOS.FV.2017.1012 |
| Megalaspis cordyla (Linnaeus, 1758) | Torpedo scad | Vankada | LC | KUFOS.FV.2020.1024 |
| Selar crumenophthalmus (Bloch,1793) | Big eye scad | Kaata paara | LC | KUFOS.FV.2017.1010 |
| 17 SPHYRAENIDAE (Barracudas) | | | |
| Sphyraena barracuda (Edwards, 1771) | Great barracuda | Cheelavu | LC | KUFOS.FV.2019.1058 |
| 18 LATIDAE (Lates perches) | | | |
| Lates calcarifer (Bloch, 1790) | Asian seabass | Kalaanji | LC | KUFOS.FV.2020.1012 |
| XI ORDER ANABANTIFORMES | | | |
| 19 ANABANTIDAE (Climbing gouramies) | | | |
| Anabas testudineus (Bloch, 1792) | Climbing perch | Karippidi | LC | KUFOS.FV.2017.1002 |
| 20 CHANNIDAE (Snakeheads) | | | |
| Channa pseudomarulius (Günther, 1861) | Great snake head | Chaerumeen | NE | KUFOS.FV.2020.1010 |
| Channa striata (Bloch, 1793) | Striped snakehead | Varal | LC | KUFOS.FV.2017.1003 |
| XII PLUERONECTIFORMES | | | |
| 21 CYNOGLOSSIDAE (Tongue fishes) | | | |
| Cynoglossus semifasciatus Day, 1877 | Bengal tonguesole | Nangu | DD | KUFOS.FV.2017.1004 |
| 22 SOLEIDAE (Soles) | | | |
| Brachirus orientalis (Bloch & Schneider, 1801) | Oriental sole | Kuruwan nangu | LC | KUFOS.FV.2020.1011 |
| XIII ORDER SCOMBRIFORMES | | | |
| 23 STROMATEIDAE (Butter fishes) | | | |
### Checklist of Fish and Shellfishes of the Poonthura Estuary, India

**Bella et al.**  
Journal of Threatened Taxa | www.threatenedtaxa.org | 26 July 2022 | 14(7): 21409–21420

| Order/Family/Species | Common name | Vernacular name | IUCN status | Voucher number |
|----------------------|-------------|-----------------|-------------|----------------|
| Pampus argenteus (Euphrasen, 1788) | Silver pomfret | Vella avoli | VU | KUFOS.FV.2019.1059 |

**XIV ORDER PERCIFORMES**

| 24 GERREIDAE (Mojarras) | Gerres filamentosus (Cuvier, 1829) | Whipfin silverbiddy | Pulli prachi | LC | KUFOS.FV.2020.1013 |
| Gerres setifer (Hamilton, 1822) | Black tipped silverbiddy | Prachi | LC | KUFOS.FV.2020.1014 |

| 25 SILLAGINIDAE (Sillagos or Whitings) | Sillago sihama (Forskål, 1790) | Silver whiting | Kalimeen | LC | KUFOS.FV.2020.1017 |

**26 SERRANIDAE (Groupers)**

| Epinephelus tautila (Forskål, 1775) | Greasy grouper | Kalava | DD | Photo voucher |

**27 MONODACTYLIDAE (Moon fishes)**

| Monodactylus argenteus (Linnaeus, 1758) | Silver moony fish | Kannadimeen | LC | KUFOS.FV.2016.1004 |

| 28 LUTJANIDAE (Snappers) | Lutjanus argentimaculatus (Forskål, 1775) | Mangrove red snapper | Velameen | LC | KUFOS.FV.2020.1016 |
| Lutjanus fulviflamma (Forskål, 1775) | Dory snapper | Pulli chemballi | LC | Photo voucher |

**29 HAEMULIDAE (Sweet lips)**

| Plectorhinchus gibbosus (Lacepède, 1802) | Brown sweetlips | Kaili | LC | KUFOS.FV.2020.1019 |

**30 TERAPONTIDAE (Grunters or Tigerfishes)**

| Terapon jarbua (Forskål, 1775) | Crescent perch | Konankora | LC | KUFOS.FV.2020.1015 |

**31 LEIOGNATHIDAE (Pony fishes or Slip mouths)**

| Eupleekeria splendens (Cuvier, 1829) | Splendid ponyfish | Mullukaara | LC | KUFOS.FV.2019.1061 |
| Gagga minuta (Bloch, 1795) | Toothed ponyfish | Chadhakaara | LC | KUFOS.FV.2019.1060 |
| Leiognathus equulus (Forskål, 1775) | Common ponyfish | Kaara poochi | LC | KUFOS.FV.2016.1005 |
| Nuchequula blochii (Valenciennes, 1835) | Twoblotch ponyfish | Paalkaara | NE | KUFOS.FV.2019.1062 |

**32 SCATOPHAGIDAE (Scats)**

| Scatophagus argus (Linnaeus, 1766) | Spotted butterfish | Pooa | LC | KUFOS.FV.2016.1006 |

**33 PALAEMONIDAE (Palaemonid shrimps)**

| Macrobrachium idella (Hilgendorf, 1898) | Slender river prawn | Koon konju | LC | KUFOS.CV.2020.1018 |
| Macrobrachium rosenbergii (De Man, 1879) | Giant river prawn | Kaalan konju | LC | KUFOS.CV.2017.1005 |

**34 PENAEIDAE (Penaeid shrimps)**

| Penaeus indicus (H. Milne-Edwards, 1837) | Indian white prawn | Naaran konju | NE | KUFOS.CV.2019.1063 |
| Penaeus monodon (Fabricus, 1798) | Giant tiger prawn | Kara konju | NE | KUFOS.CV.2017.1006 |

**35 PORTUNIDAE**

| Scylla serrata (Forskål, 1775) | Green mud crab | Kaval Njandu | NE | KUFOS.CV.2017.1007 |

LC—Least Concern | DD—Data Deficient | NE—Not Evaluated | VU—Vulnerable | TR—Transplanted | EX—Exotic | B—Brackishwater | F—Freshwater | M—Marine

The conservation and management of Poonthura estuary necessitates a holistic approach that takes into account the ecosystem balance and function as well as the restoration of the natural fish diversity of the estuary, thus ensuring fishing activities that are economically viable in the long-term.

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Image 2a. Fish species recorded from the Poonthura estuary. © Kiranya B.

Image 2b. Fish species recorded from the Poonthura estuary. © Kiranya B.
Image 2c. Fish species recorded from the Poonthura estuary. © Kiranya B.

Image 2d. Fish species recorded from the Poonthura estuary. © Kiranya B.
Image 2e. Fish species recorded from the Poonthura estuary. © Kiranya B.

Image 2f. Fish species recorded from the Poonthura estuary. © Kiranya B.
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| **Reptiles** |
|----------------|
| Dr. Gernot Vogel, Heidelberg, Germany |
| Dr. Raju Vyas, Vadodara, Gujarat, India |
| Dr. Pratpal S. Soorae, Environment Agency, Abu Dhabi, UAE |
| Prof. Dr. Wayne J. Fuller, Stanford Libraries, Virtual Library of Biology, Zoological Records. |

**NAAAS rating (India)** 5.64

| **Fishes** |
|----------------|
| Dr. Neelesh Dahanukar, IISER, Pune, Maharashtra, India |
| Dr. Topiltzin Contras Macbeath, Universidade Autônoma do Estado de Morelos, México |
| Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore |
| Dr. Rajeev Raghavan, St. Albert’s College, Kochi, Kerala, India |
| Dr. Robert D. Silka, Chiltern Gateway Project, A Rocha UK, Southall, Middlesex, UK |
| Dr. John T.D. Caleb, Zoological Survey of India, Kolkata, West Bengal, India |
| Dr. Priyadarshini Dharma Rajan, Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Bangalore, Karnataka, India |

**Mammals**

| Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia |
| Mr. H. Byju, Coimbatore, Tamil Nadu, India |
| Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK |
| Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India |
| Dr. J.W. Duckworth, IUCN SSC, Bath, UK |
| Dr. Rajah Jayapal, SACC0, Coimbatore, Tamil Nadu, India |
| Dr. Raji S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India |
| Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India |
| Dr. C. Sriwassu, Osmington, Hyderbad, India |
| Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA |
| Dr. Gombazabara Sundar, Professor of Ornithology, Ulanbaatar, Mongolia |
| Prof. Reuven Yosef, International Birding & Research Centre, Eliat, Israel |
| Dr. Taej Munduk, Wetlands International, Wageningen, The Netherlands |
| Dr. Carol Inskip, Bishop Auckland Co., Durham, UK |
| Dr. Tim Inskip, Bishop Auckland Co., Durham, UK |
| Dr. V. Gokul, National Institute of Technology, Tiruchirapalli, Tamil Nadu, India |
| Dr. Arkady Lelej, Russian Academy of Sciences, Vladivostok, Russia |
| Dr. Simon Dowell, Science Director, Chester Zoo, UK |
| Dr. Mário Gabriel Santacruz dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, Vila Real, Portugal |
| Dr. Grant Connette, Smithsonian Institution, Royal, VA, USA |
| Dr. M. Zafar-ul Islam, Prince Saud Al Faisal Wildlife Research Center, Taif, Saudi Arabia |

**Amphibians**

| Dr. Sushil K. Dutta, Indian Institute of Science, Bengaluru, Karnataka, India |
| Dr. Annamie Oehler, Museum national d’Histoire naturelle, Paris, France |

**Reptiles**

| Dr. Gornet Vogel, Heidelberg, Germany |
| Dr. Raju Vyas, Vadodara, Gujarat, India |
| Dr. Pratpal S. Soorae, Environment Agency, Abu Dhabi, UAE |
| Prof. Dr. Wayne J. Fuller, Near East University, Mersin, Turkey |
| Prof. Dr. Chadrashaher u. R. Irivonker, Goa University, Talegaon Plateau, Goa, India |
| Dr. S.R. Ganesh, Chennai Snake Park, Chennai, Tamil Nadu, India |
| Dr. Himanshu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE |

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| Dr. Himanshu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE |

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Articles

The Javan Leopard Panthera pardus melas (Cuvier, 1809) (Mammalia: Carnivora: Felidae) in West Java, Indonesia: estimating population density and occupancy
– Anton Ario, Senjaya Garcia, Marco Sandoval, Vivian R. González-Castillo, Gerber D. Guzmán-Flores & Cristel M. Pineda, Pp. 21388–21395

Breeding phenology and population dynamics of the endangered Forest Spiny Reed Frog Afrixalus sylvaticus Schistz, 1974 in Shimba Hills, Kenya
– Alfayo Koskei, George Eshiamwata, Bernard Kirui & Phylus K. Cheruiyot, Pp. 21395–21396

Ichthyofaunal diversity of Senkhi stream, Itanagar, Arunachal Pradesh: a comparative status between 2004–05 and 2018–19
– Koj Taro, Lakpa Tamang & D.N. Das, Pp. 21356–21367

First record of Proceratum Roger, 1863, Zasphinctus Wheeler, 1918, and Vollenhovia Mayr, 1865 (Hymenoptera: Formicidae) from the Western Ghats of peninsular India, description of three new species, and implications for Indian biogeography
– Kalesh Sadasivan & Manoj Kripakaran, Pp. 21368–21387

Communications

New queen? Evidence of a long-living Jaguar Panthera onca (Mammalia: Carnivora: Felidae) in Tikal National Park, Guatemala
– Carlos A. Gaitán, Manolo J. García, M. André Sandoval-Lemus, Vivian R. González-Castillo, Gerber D. Guzmán-Flores & Cristel M. Pineda, Pp. 21388–21395

First camera trap record of Striped Hyena Hyaena hyaena (Linnaeus, 1758) (Mammalia: Carnivora: Hyaenidae) in Parsa National Park, Nepal
– Pramod Raj Regmi, Chhewang P. Sigdel, Dipendra Adhikari, Naresh Subedi & Babu Ram Lamichhane, Pp. 21402–21408

Range extension and new ecoregion records of the Crocodile Monitor Varanus salvator (Peters & Doria, 1878) (Reptilia: Varanidae) in Papua New Guinea
– Borja Reh & Jim Thomas, Pp. 21402–21408

A checklist of fish and shellfishes of the Poonthura estuary, southwestern coast of India
– Kiranya Bella, Pramila Sahadevan, Giri Bhavan Sreekantan & Rajeev Raghavan, Pp. 21409–21420

A new species of Protosticta Selys, 1885 (Odonata: Zygoptera: Platystictidae) from Western Ghats, India
– Kalesh Sadasivan, Vinayan P. Nair & K. Abraham Samuel, Pp. 21421–21431

A case study on utilization and conservation of threatened plants in Sechu Tuan Nalla Wildlife Sanctuary, western Himalaya, India
– Puneet Kumar, Harminder Singh & Sushil Kumar Singh, Pp. 21432–21441

A survey of ethno-medicinally important tree species in Nauradehi Wildlife Sanctuary, central India
– Tinku Kumar, Akash Kumar, Amit Jugnu Bishwas & Pramod Kumar Khare, Pp. 21442–21448

Short Communications

Effects of a Bengal Slow Loris Nycticebus bengalensis (Primates: Lorisidae) bite: a case study from Murlen National Park, Mizoram, India
– Amrit Kumar Bal, Anthony J. Giordano & Sushanto Gouda, Pp. 21449–21452

First record of Garra birostris Nebeshwar & Vishwanath, 2013 (Cypriniformes: Cyprinidae) from Doyang and Dikhu rivers of Brahmaputra drainage, Nagaland, India
– Sophiya Ezung, Metevinu Kechu & Pranay Punj Pankaj, Pp. 21453–21457

Two new records of Lilac Silverline Apharitis lilacinus (Lepidoptera: Lycaenidae) from northeastern India
– Monsoon Jyoti Gogoi, Ngulkholal Khongsai, Biswajit Chakdar & Girish Jathar, Pp. 21458–21461

Illustrated description of the mantis Mesopteryx platyccephala (Mantodea: Mantidae) collected from West Bengal, India
– Gauri Sathaye, Sachin Ranade & Hemant Ghate, Pp. 21462–21466

Illustrated description of the mantis Catrelia isidiata (Asahina) W.L. Culb. & C.F. Culb. (Pamphiliaceae) – an addition to the Indian lichen biota
– Gaurav K. Mishra, Pooja Maurya & Dalip K. Upadhyay, Pp. 21467–21469

Notes

A new southern distribution record for Pacific Marten Martes caurina
– Maximilian L. Allen, Brianne Kenny, Benjamin Crawford & Morgan J. Farmer, Pp. 21470–21472

First Asian record of Light-mantled Albatross Phoebetria palpebrata (Foster, 1785) from Rameswaram Island, Tamil Nadu, India
– H. Byju & N. Raveendran, Pp. 21473–21475

Salvia misella Kunth (Lamiaceae) - a new record for Eastern Ghats of India
– Prabhat Kumar Das, Pradeep Kumar Kamila & Pratap Chandra Panda, Pp. 21576–21579

Salsola oppositifolia Desf. In Great Rann of Kachchh, Gujarat – a new record for India
– Rakesh Gujar, Vinesh Gamit, Ketan Tatu & R.K. Sugoor, Pp. 21580–21583

Extended distribution of Impatiens scapiflora (Balsaminaceae) to the flora of Eastern Ghats, India
– T.S. Saravanan, S. Kaliamaorthy, M.Y. Kamble & M.U. Sharief, Pp. 21484–21486