



Ichthyofauna of Maben Wathurawa Swamp Forest, southwestern Sri Lanka

In Sri Lanka, the highest number of endemic and threatened freshwater fish species is found in the south-west and most records are from outside the protected area network. They may therefore be severely impacted by anthropogenic activities (Pethiyagoda 1994, Goonatilake *et al.* 2020). Forested streams support higher fish biomass than non-forested streams (Lo *et al.* 2020), and almost all the endemics are strongly associated with shaded habitats (Pethiyagoda 1991). The Maben Wathurawa Swamp Forest (hereafter MWSF; Fig. 1), has been proposed as a forest reserve for several decades (Survey General Ceylon 1972) but there is no information available on the ichthyofaunal assemblages in that forest.

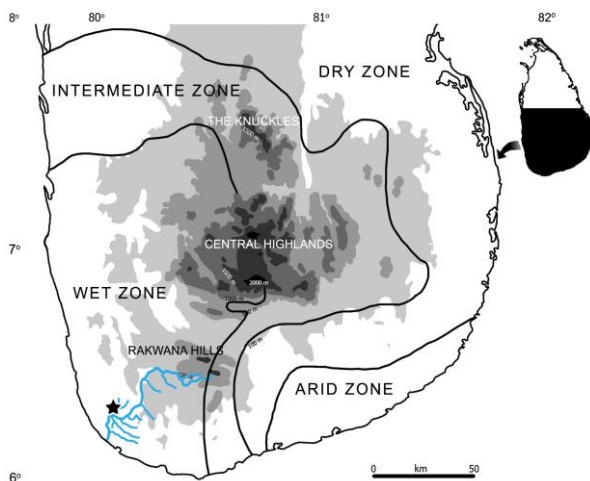


Figure 1. Location of the Maben Wathurawa Swamp Forest (star) and the Gin River Basin (in blue) in south-west Sri Lanka. © Map: A.A.T. Amarasinghe

MWSF is flooded periodically by water from the Maben-Ela tributary connects to the Gin River at Agaliya, creating several ephemeral streams and pools in the low-lying parts of the forest. These pools are considered to be the most important habitats and breeding grounds for diverse endemic and indigenous fish species.

Thus, the present study aimed to document the ichthyofaunal assemblages and ascertaining the status of fish species in MWSF ($6^{\circ}11'7.00''$ – $6^{\circ}14'19.61''$ N, $80^{\circ}10'5.85''$ – $80^{\circ}14'10.53''$ E; alt. 4–150 m a.s.l.), which is located in the Welivitiya-Divitura Divisional Secretariat Division in Galle District of southern Sri Lanka. The MWSF is relatively dry from January to April (dry season) and receives heavy rain during the rest of the year (wet season), mainly from the southwest monsoon from May to September. We carried out this study during both dry and wet seasons from January to December 2018. During the wet season, water bodies throughout MWSF are connected but during the dry season, water bodies are not connected and act as refuges for fish.

Sampling localities were chosen to cover all fish habitats. The physicochemical parameters, temperature, pH, dissolved oxygen (DO) and total dissolved solids (TDS) were measured in each sampled water body by using a hand held environmental multi-probe (Hanna, USA: model HI 98194) submerged 15 cm below the surface until value stabilized. Fish samples were collected by seining with a small-meshed net (300 cm in length and 150 cm in width, stretched mesh size 8 mm). The physicochemical data are summarized in Table 1. All parameters fluctuated within a narrow range between wet and dry seasons. Fish were identified to species level with the aid of field guides (e.g. Deraniyagala 1952, Pethiyagoda 1991, Goonatilake 2007, De Silva *et al.* 2015), taxonomic references (e.g. Silva *et al.* 2008, Pethiyagoda *et al.* 2012, Sudasinghe & Meegaskumbura 2016, Sudasinghe *et al.* 2016) and recent taxonomic reviews (e.g. Abesinghe *et al.* 2020, Sudasinghe *et al.* 2020a–f). A checklist of the species was produced along with the National IUCN status (NS) of species in Sri Lanka and Global IUCN status (GS) of those same species were listed based on Goonatilake *et al.* 2020 (Appendix).

We recorded a total of 34 fish species belonged to 28 genera from 17 families. 21

species are indigenous (61.8%), a further nine are endemic (26.5%) and four exotic (11.8%). Two indigenous species; *Puntius vittatus* and *Rasbora dandia*, and one endemic species; *Pethia cumingii* were the most prevalent at $49.89 \pm 4.24\%$, $11.33 \pm 2.82\%$ and $24.05 \pm 6.53\%$, respectively. Of the exotic species, *Osphronemus goramy* was the most prevalent at $0.44 \pm 0.17\%$. Over 50% of fish belonged to four families. Cyprinidae was the most diverse family represented by 13 species, followed by Channidae and Ospronemidae each with three species. The family Cichlidae was represented by two species. The other families (see Appendix) were represented by a single species each. Based on IUCN Red List status 19 species are of Least Concern (LC), four are Endangered (EN), four are Vulnerable (VU) and three are Near Threatened (NT), see Appendix.

Table 1. Physicochemical parameters of waters in MWSF, Sri Lanka during 2018; dry season = January–April, wet season = May–December.

parameter	dry	wet	average
	season	season	
	(\pm sd)	(\pm sd)	(\pm sd)
temperature ($^{\circ}$ C)	26.65 ± 1.2	26.45 ± 0.2	26.51 ± 0.6
pH	6.30 ± 1.1	6.56 ± 0.5	6.50 ± 0.7
DO (ppm)	5.76 ± 0.9	5.61 ± 0.4	5.65 ± 0.6
TDS (ppt)	0.02 ± 0.0	0.01 ± 0.0	0.02 ± 0.0

The family Cyprinidae is the most speciose group of freshwater fishes in the world (Muchlisin *et al.* 2015) and was also the dominant family recorded from the MWSF ecosystem. It also accounts for 30.9% of freshwater fish species recorded from Sri Lanka (Goonatilake *et al.* 2020). Flooding from monsoonal rains in the wet season creates a network of freshwater swamps that is considered by some to be one of the most spectacular in the world (Siriwardana & Sangasumana 2018).

Freshwater fish species, inhabiting undisturbed natural habitats have well defined niche segregation and ecological adaptations evolved over centuries. But tropical freshwater forest biodiversity is rapidly declining due to anthropogenic pressure (Lo *et al.* 2020), and exotic species have become established mainly in highly disturbed areas where no native fish now occur (Senanayake & Moyle 1982).

Invasive exotic species usually predate on local fish, compete with local species for habitat and food (Alcaraz & Garcia-Berthou 2007), interfere with mate selection (Seehausen *et al.* 1997) and transmit disease to local species (Almodovar *et al.* 2006). There is a low prevalence of exotic invasive species (morphotypes of *Pterygoplichthys pardalis* and *P. disjunctivus*) in MWSF, indicating that they have not become well established in this swamp forest (Abesinghe *et al.* 2020). MWSF has been proposed as a reserved forest based mainly on the terrestrial biodiversity. The present findings on fish fauna add weight to that proposal, warrant encouraging policymakers to fulfill the long-term plan of declaring MWSF as a reserved forest.

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K.H.M.A. Deepananda^{1,3}, K. Wewalwala²,
P.K.W.I.N. Rathnayake¹, H.M.V. Udayantha¹,
G.A.T.K. Yomal¹, R.B.D.D. Senarathne¹,
A.U. Kuragodage¹ & S.U. Thuduwege²

¹ Department of Fisheries & Aquaculture, Faculty of Fisheries, Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka

² Biodiversity Education and Exploration Society, Wackwella Road, Galle, Sri Lanka

³ E-mail: ashoka@fish.ruh.ac.lk

Appendix. Species checklist in MWSF with the IUCN conservation status (based on Goonatilake 2020), and the prevalence of species; E, endemic; I, indigenous. * exotic, NS, national status; GS, global status; LC, Least Concern; EN, Endangered; NT, Near Threaten; VU, Vulnerable; — not applicable

Family and species	Common name	IUCN status		Prevalence \pm sd
		NS	GS	
Anabantidae				
1 <i>Anabas testudineus</i> ^I	climbing perch	LC	LC	0.27 \pm 0.1
Anguillidae				
2 <i>Anguilla bicolor</i> ^I	level-finned eel	NT	NT	0.17 \pm 0.1
Aplocheilidae				
3 <i>Aplocheilus parvus</i> ^I	dwarf panchax	LC	LC	0.13 \pm 0.0
Bagridae				
4 <i>Mystus nanus</i> ^I	Striped dwarf catfish	LC	LC	0.25 \pm 0.2
Belonidae				
5 <i>Xenentodon cancila</i> ^I	fresh water garfish	VU	LC	0.22 \pm 0.1
Channidae				
6 <i>Channa cf. ara</i> ^E	giant snakehead	VU	LC	0.20 \pm 0.1
7 <i>Channa punctata</i> ^I	spotted snakehead	NT	LC	0.34 \pm 0.2
8 <i>Channa striata</i> ^I	murrel	LC	LC	0.23 \pm 0.1
Cichlidae				
9 <i>Etroplus suratensis</i> ^I	green chromide	LC	LC	0.22 \pm 0.1
10 <i>Oreochromis mossambicus</i> [*]	Mozambique tilapia	—	VU	0.27 \pm 0.1
Clariidae				
11 <i>Clarias brachysoma</i> ^E	walking catfish	NT	NT	0.22 \pm 0.1
Cobitidae				
12 <i>Lepidocephalichthys thermalis</i> ^I	common spiny loach	LC	LC	0.29 \pm 0.1
Cyprinidae				
13 <i>Amblypharyngodon grandisquamis</i> ^E	large silver carplet	LC	LC	0.27 \pm 0.1
14 <i>Devario malabaricus</i> ^I	giant danio	LC	LC	0.24 \pm 0.1
15 <i>Dawkinsia filamentosae</i> ^I	filamented barb	LC	LC	3.30 \pm 1.1
16 <i>Esomus thermoicos</i> ^I	flying barb	LC	LC	2.33 \pm 0.7
17 <i>Laubuka varuna</i> ^E	southern laubuca	EN	EN	2.61 \pm 0.7
18 <i>Pethia cumingii</i> ^E	Cuming's barb	EN	EN	24.05 \pm 6.5
19 <i>Pethia nigrofasciata</i> ^E	black ruby barb	VU	VU	0.14 \pm 0.1
20 <i>Puntius kamalika</i> ^E	Kamalika's barb	EN	EN	0.15 \pm 0.0
21 <i>Puntius kelumi</i> ^E	Kalum's barb	EN	EN	0.18 \pm 0.1
22 <i>Puntius vittatus</i> ^I	silver barb	LC	LC	49.89 \pm 4.2
23 <i>Rasbora dandia</i> ^I	striped rasbora	LC	LC	11.33 \pm 2.8
24 <i>Rasbora microcephalus</i> ^I	common rasbora	LC	LC	0.23 \pm 0.1
25 <i>Systemus sarana</i> ^I	olive barb	LC	LC	0.30 \pm 0.2
Eleotridae				
26 <i>Eleotris fusca</i> ^I	brown gudgeon	LC	LC	0.11 \pm 0.1
Gobiidae				
27 <i>Awaous melanocephalus</i> ^I	scribbled goby	LC	LC	0.23 \pm 0.1
Heteropneustidae				
28 <i>Heteropneustes fossilis</i> ^I	stinging catfish	LC	LC	0.25 \pm 0.1
Loricariidae				
29 <i>Pterygoplichthys pardalis</i> [*] or <i>P. disjunctivus</i> [*]	orinoco sailfin catfish	—	—	0.12 \pm 0.1
Mastacembelidae				
30 <i>Mastacembelus armatus</i> ^I	marbled spiny eel	LC	LC	0.32 \pm 0.1
Osphronemidae				
31 <i>Osphronemus goramy</i> [*]	giant gourami	—	LC	0.44 \pm 0.2
32 <i>Pseudosphromenus cupanus</i> ^I	spiketailed paradisefish	LC	LC	0.19 \pm 0.1
33 <i>Trichopodus pectoralis</i> [*]	snakeskin gourami	—	LC	0.28 \pm 0.1
Siluridae				
34 <i>Ompok argestes</i> ^E	wet zone butter catfish	VU	VU	0.29 \pm 0.1