

FRESHWATER FISHES OF SUNGAI SAT AND SUNGAI KELAPAH, TAMAN NEGARA NATIONAL PARK, PAHANG

**Farah Ayuni Farinordin, Noor Nabilah Nazri, Abdullah Samat,
David Magintan, A.K Jalaludin Pangeran Besar,
Mohd Fauzi Sayuti & *Shukor Md Nor**

*Pusat Pengajian Sains Sekitaran dan Sumber Alam,
Fakulti Sains dan Teknologi,
Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor*

*Corresponding author's e-mail: shukormn63@gmail.com

ABSTRACT

A survey of freshwater fish community in Kuala Kelapah, a part of Taman Negara National Park, Kuala Tahan, Pahang was conducted in conjunction with the 2015 Biodiversity Inventory Programme organised by the Department of Wildlife and National Parks. A total of 544 individual fishes were caught; belonging to 12 families, 28 genera, and 34 species. Cyprinidae was found to be the most dominant family (87.32%). Out of 34 species, *Lobocheilos rhabdoura* was the most abundant species recorded amounting to 45.96% of all individuals caught. One species has been listed as Near Threatened by the International Union for Conservation of Nature (IUCN), which is *Bagarius yarrelli*. The number of species found was higher in Sungai Sat (28 species) compared to in Sungai Kelapah (19 species). Thirteen similar species were found in both rivers, showing that the occurrence of similar species between these rivers was 38.24%. The species composition and richness of freshwater fish are mainly influenced by habitat profile and physico-chemical parameters of the water. Species diversity at Kuala Kelapah was low and the distribution is mainly dominated by one single species.

Keywords: freshwater fish, *Lobocheilos rhabdoura*, Sungai Kelapah, Sungai Sat, Taman Negara National Park

*Received (21-December-15); Accepted (18-March-16);
Available online (15-August-16)*

Citation: Farinordin, F.A., Nazri, N.N., Samat, A., Magintan, D., Besar, A.K.J.P,

Sayuti, M.F. & Nor, S.M. (2016). Freshwater fishes of Sungai Sat and Sungai Kelapah, Taman Negara National Park, Pahang. *Journal of Wildlife and Parks*, **31**: 49-60.

INTRODUCTION

The Taman Negara National Park (TNNP) is the oldest and largest protected area located in the central region of Peninsular Malaysia (Mohd-Rasdi *et al.*, 2012). It is one of the world's most complex and richest ecosystems (Zulkiflee *et al.*, 2012). It is also one of the main regions that contribute to the richness of wildlife in Peninsular Malaysia (DWNP, 2000; Zanisah *et al.*, 2009; Fatanah *et al.*, 2012; Mohd-Salleh *et al.*, 2012). It has wide range of habitat types, such as lowland that consists of riverine vegetation, hill dipterocarp forest, lower and upper montane forest, heath forest, and riparian forest (Tingga *et al.*, 2012). Rivers and freshwater areas are among the important ecosystems that are continuously studied in TNNP.

Numerous studies have been conducted on freshwater fish diversity in Pahang River basin such as studies by Lee and Zakaria-Ismail (1996) and Salim-Khan *et al.* (1996), but a few were emphasized on tributaries inside this gazetted area. Checklist of fish species in TNNP was published as early as 1984 by Zakaria-Ismail (1984). In the later studies, Mustafa *et al.* (2008) reported a total of 33 species in Sungai Atok, while Mohd-Azham and Singh (2012) reported that 17 species were found in Sungai Keniam. Zulkafli *et al.* (2015) on the other hand produced a comprehensive checklist of 82 freshwater fish species of Sungai Tembeling which borders the TNNP and Sungai Pahang. However, their study did not include any of the streams that flow in the TNNP itself. Up to date, there are still no reports on fish assemblages in Sungai Kelapah, a tributary of Sungai Sat. Therefore, this study aims to provide a baseline data regarding the occurrence and abundance of freshwater fishes of Sungai Kelapah and Sungai Sat.

METHODOLOGY

Study Site

Sungai Pahang is divided into two main rivers in the north of Pahang namely Sungai Tembeling and Sungai Jelai. Both rivers meet at a confluence at Kuala Tembeling, which is situated about 300 km away from the estuary of Sungai

Pahang (Kamarudin *et al.* 2014; Zulkafli *et al.* 2015). Sungai Tembeling and its tributaries such as Sungai Tenur, Sungai Mentut, Sungai Kceau, Sungai Tanung, Sungai Tabung, Sungai Terengan, and Sungai Jintoh flow through Taman Negara. This study was conducted from the 6th to 8th of August 2015 in conjunction with the 2015 Biodiversity Inventory Programme organised by the Department of Wildlife and National Parks (DWNP). During this inventory, fishes were collected at Sungai Sat (4°34.114'N, 102°34.684'E) and the feeder stream of Sungai Sat, namely Sungai Kelapah (4°33.969'N, 102°34.908'E). Both rivers are located in the northern part of Kuala Sat, Ulu Tembeling, Jerantut (Figure 1).

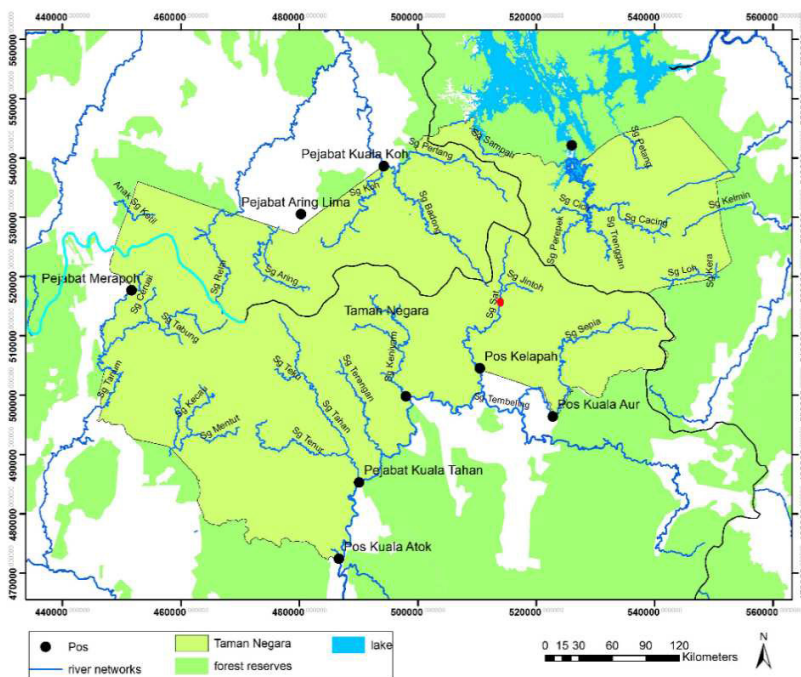


Figure 1 Sampling site marked with a red dot.

Measurements of river depth, width, and velocity were taken *in situ*. The pH values, electrical conductivity, turbidity, dissolved oxygen, and total dissolved solids were taken by using the YSI, model 556 MPS. Water samples were taken for analysis of phosphate, nitrate, sulfate, and ammonia levels by using spectrophotometer model HACH DR2000 according to protocols provided by The Water Analysis Handbook by HACH Company in the laboratory.

Specimen Collection

Fishing was conducted by using a cast net, an electric shocker, 20 m gill nets of 2.5 inches in size, and scoop nets. A backpack electro-fisher (model Smith-Root LR-20) was used to collect the fish samples in shallow waters, about 100 m distance. Gill nets were placed 15 m to 30 m across the river at relatively deeper and slower flowing water and left overnight. The length and weight of the fish were measured subsequent to the catching activity. Voucher specimens collected were labelled and preserved in 10% formalin and deposited in Museum of Zoology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia for further examination. The fishes were sorted and grouped based on their common names and external morphologies. They were then identified based on the taxonomic keys by Kottelat *et al.* (1993).

RESULTS AND DISCUSSIONS

According to Gorman and Karr (1978), substrate, depth, and current are three components of stream environments that are important in the microhabitat specialization of stream fishes. Substrate of running waters is critical to many fishes as structures for shelters from current or predators. Depth allows the determination of community diversity while current conveys transport of resources and removal of wastes (Allan, 1995).

The average width of Sungai Sat was about 30 m with an average depth of about 0.8 m while the water velocity was about 0.5 m/s. Sungai Sat was described as having a low percentage of forest canopies (5%-10%). Its bottom substrates were composed of gravel, mud, and sand while the riverbank was lined with bedrock and cobbles. The channel bed of Sungai Sat consists of a series of rapids and cascades. There was also some large amount of woody debris in the stream during this survey, which could provide suitable shelters for the fishes. These kinds of river structures would be suitable as breeding sites for more fish species.

Sungai Kelapah was different compared to Sungai Sat in terms of its size and other physical structures. The average width of Sungai Kelapah was 4.4 m with an average depth of 0.27 m. The streams of Sungai Kelapah have formed pools, which can be characterised by a lower water velocity (0.04 m/s). Unlike Sungai Sat, Sungai Kelapah was shaded by more forest canopies (80%-100%). Sungai Kelapah was characterised by its well-developed strip of beaches and riffle-pool formations that were covered by thin layers of sediment. Its bottom substrates

were made up of small rocks. More physical characteristics of Sungai Sat and Sungai Kelapah are listed in Table 1.

The physico-chemical parameters of the water are also considered as important factors affecting fish abundance and distribution. The level of dissolved oxygen in Sungai Sat was ± 79.8 % while the total dissolved solid and pH was ± 0.022 mg/L and ± 6.86 , respectively. Overall, Sungai Sat is observed as a clean river, which was most probably due to the absence of any anthropogenic disturbances. In comparison, the level of dissolved oxygen recorded in Sungai Kelapah was ± 57 %, while the total dissolved solid and pH was ± 0.035 mg/L and ± 7.16 , respectively. Higher concentrations of ammonia and nitrate were recorded at Sungai Kelapah than at Sungai Sat, but the phosphate concentration was fairly similar for both streams, as shown in Table 2.

Table 1 River physical structures at Sungai Sat and Sungai Kelapah.

Habitat Structure	Sungai Sat	Sungai Kelapah
Elevation (m)	154	126
Width (m)	30	4.4
Depth (m)	0.8	0.27
Velocity (m/s)	0.5	0.04
River substrates	Sand, mud, gravel	Sand, mud

Table 2 Physicochemical parameters of study sites.

Parameter	Sungai Sat	Sungai Kelapah
Temperature (°C)	± 23.26	± 20.72
Dissolved oxygen (%)	± 79.8	± 57
pH	± 6.86	± 7.16
Electrical Conductivity ($\mu\text{s}/\text{cm}$)	± 0.033	± 0.048
Total dissolved solid (mg/L)	± 0.022	± 0.035
Sulphate (mg/L)	0	0
Ammonia (mg/L)	± 0.458	± 0.54
Nitrate (mg/L)	± 0.34	± 0.94
Phosphate (mg/L)	± 0.316	± 0.226

A total of 405 and 139 fishes were caught in Sungai Sat and Sungai Kelapah, respectively, making the total number of individuals as 544 (see Table 3). Sungai

Sat was composed of 11 families, 26 genera, and 28 species. Cyprinidae was the dominant family and represents about 86.9% of all specimens from the stream, which was followed by Balitoridae (4.4%), Mastacembelidae (2.7%), Cobitidae (2.2%), Bagridae (1.2%), and Belonidae (1%). Akysidae, Nandidae, Siluridae, Sisoridae, and Tetraodontidae each contributed 0.2% of the total number of individuals. Out of the 28 species, one has been listed as Near Threatened by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, which is *Bagarius yarrelli* (Kenerap). *Lobocheilos rhabdoura* (Jemerong) (Figure 2) was found to be the most dominant species, with 250 individuals caught during this survey. This species is frequently found swimming in groups and prefers upstream because of its clean habitats and rocky substrates. In Sungai Kelapah, there were 7 families, 15 genera, and 19 species recorded. Cyprinidae was also the dominant family found in this stream, which represents about 87.7% of all individuals. This was followed by Nandidae (5.8%) and Channidae (3.6%). Meanwhile, Bagridae, Belonidae, Cobitidae, and Mastacembelidae each contributed 0.7% of the total number of fish individuals caught. *Labiobarbus fasciatus* (Kawan) was found to be the most dominant species which represents 6.62% of the overall catch.

Table 3 List of ichthyofaunal species distributed in Sungai Sat and Sungai Kelapah, Taman Negara National Park, Kuala Tahan, Pahang (NE=Not Evaluated; LC=Least Concerned; DD=Data Deficient; NT=Near Threatened).

No.	Species	Local Name	Status (IUCN)	Sungai Sat	Sungai Kelapah
Family Akysidae					
1.	<i>Acrochordonichthys ischnosoma</i>	Depu Jeram	NE	1 (0.2)	0 (0)
Family Bagridae					
2.	<i>Leiocassis poecilopterus</i>	Baung Pisang	NE	1 (0.2)	1 (0.7)
3.	<i>Hemibagrus gracilis</i>	Baung Akar	LC	4 (1)	0 (0)
Family Balitoridae					
4.	<i>Nemacheilus masyae</i>	Loc Pasir	DD	9 (2.2)	0 (0)
5.	<i>Nemacheilus selangoricus</i>	Loc Pasir	DD	9 (2.2)	0 (0)
Family Belonidae					
6.	<i>Xenentodon canciloides</i>	Julong Sungai	LC	4 (1)	1 (0.7)
Family Channidae					
7.	<i>Channa lucius</i>	Bujuk	LC	0 (0)	5 (3.6)
Family Cobitidae					

8.	<i>Acanthopsis choirorhynchos</i>	Loc Kuda	LC	6 (1.5)	0 (0)
9.	<i>Syncrossus hymenophysa</i>	Lali	NE	3 (0.7)	1 (0.7)
Family Cyprinidae					
10.	<i>Barbichthys laevis</i>	Bentulu	LC	3 (0.7)	2 (1.4)
11.	<i>Puntius lateristiga</i>	Bagoh	LC	0 (0)	14 (10)
12.	<i>Barbonymus schwanenfeldii</i>	Lampam Sungai	LC	6 (1.5)	0 (0)
13.	<i>Crossocheilus oblongus</i>	Selimang	LC	22 (5.4)	0 (0)
14.	<i>Cyclocheilichthys apogon</i>	Chemperas	LC	1 (0.2)	23 (16.5)
15.	<i>Hampala macrolepidota</i>	Sebarau	LC	4 (1)	1 (0.7)
16.	<i>Hypsibarbus pierrei</i>	Krai Jelawat	DD	1 (0.2)	0 (0)
17.	<i>Labiobarbus fasciatus</i>	Kawan	NE	12 (3)	24 (17.3)
18.	<i>Lobocheilos rhabdoura</i>	Jemerong	LC	250 (61.7)	0 (0)
19.	<i>Luciosoma setigerum</i>	Nyuar	DD	0 (0)	10 (7.2)
20.	<i>Mystacoleucus marginatus</i>	Sia	LC	18 (4.4)	1 (0.7)
21.	<i>Osteochilus enneaporos</i>	Rong Merah	LC	0 (0)	1 (0.7)
22.	<i>Osteochilus vittatus</i>	Tebal Sisik	LC	15 (3.7)	9 (6.5)
23.	<i>Osteochilus waandersii</i>	Rong	LC	11 (2.7)	10 (7.2)
24.	<i>Puntioplites bulu</i>	Tengalan	DD	4 (1)	0 (0)
25.	<i>Raiamas guttatus</i>	Sikang	LC	1 (0.2)	0 (0)
26.	<i>Rasbora sumatrana</i>	Seluang Sumatera	NE	0 (0)	8 (5.8)
27.	<i>Rasbora elegans</i>	Seluang Tompok	LC	0 (0)	11 (7.9)
28.	<i>Rasbora paviana</i>	Seluang	LC	5 (1.2)	8 (5.8)
Family Mastacembelidae					
29.	<i>Mastacembelus favus</i>	Tilan	LC	7 (1.7)	1 (0.7)
30.	<i>Mastacembelus unicolor</i>	Tilan	NE	4 (1)	0 (0)
Family Nandidae					
31.	<i>Pristolepis grootii</i>	Patung	LC	1 (0.2)	8 (5.8)
Family Siluridae					
32.	<i>Ompok siluroides</i>	Tapah Bem- ban	NE	1 (0.2)	0 (0)
Family Sisoridae					
33.	<i>Bagarius yarrelli</i>	Kenerap	NT	1 (0.2)	0 (0)
Family Tetraodontidae					
34.	<i>Tetraodon</i> sp.	Buntal	NE	1 (0.2)	0 (0)

Total no. of individuals	405 (100)	139 (100)
Total no. of species	28	19
Total no. of families	11	7

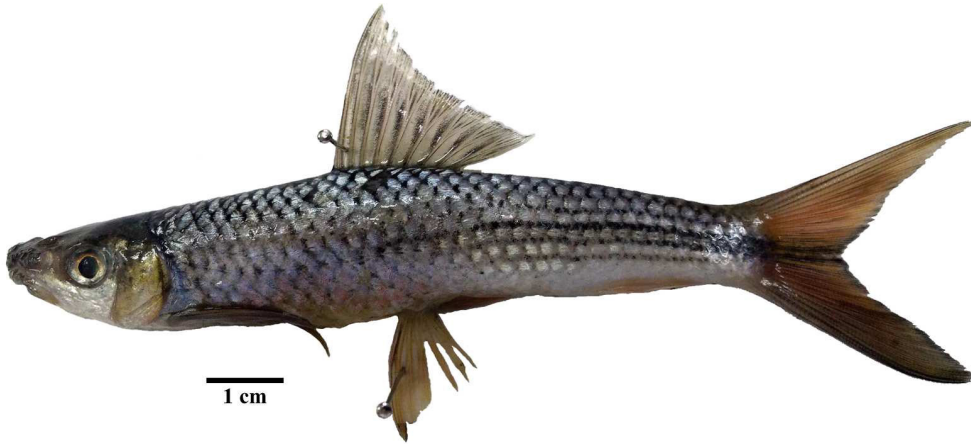


Figure 2 *Lobocheilos rhabdoura* (Fowler, 1934), locally known as Jemerong was the most dominant species caught during this survey.

Species richness and abundance were both higher in Sungai Sat since the total number of species and individuals collected were 28 and 405, respectively, compared to in Sungai Kelapah with only 19 species and 139 individuals. However, Sungai Sat was dominated by one particular species, *L. rhabdoura*. Out of the 34 species, 13 were found in both Sungai Sat and Kuala Kelapah. They are *Leiocassis poecilopterus*, *Xenentodon canciloides*, *Syncrossus hymenophysa*, *Barbichthys laevis*, *Cyclocheilichthys apogon*, *Hampala macrolepidota*, *Labiobarbus fasciatus*, *Mystacoleucus marginatus*, *Osteochilus vittatus*, *Osteochilus waandersii*, *Rasbora paviana*, *Mastacembelus favus*, and *Pristolepis grootii*. These 13 species tolerated living and adapting to both types of river environments. All of them except *S. hymenophysa* (Figure 3) are widely spread throughout Peninsular Malaysia. *S. hymenophysa* is common in TNNP and also has been recorded at Lake Chenderoh, Perak (Ambak *et al.* 2012). The presence of similar species in both habitats might be due to fish movement in search of food sources or spawning areas (Gorman & Karr, 1978). The formation of pools in Sungai Kelapah offer excellent refuges for some fishes during dry periods while the presence of tree shade decreases heat loads (Allan, 1995).

Changes in fish communities along a stream are due to changes in habitat characteristics and may be reflected as species addition, species replacement, or by changing relative abundances (Gorman & Karr, 1978). More diverse river substrates in Sungai Sat compared to Sungai Kelapah contributes to higher species richness and this can be supported by a study conducted by Allan (1995) who summarized that species richness is correlated with substrate diversity. Besides that, growth rates, life cycles, and the productivity of the entire stream systems are strongly under the influence of temperature (Allan, 1995). Greater species richness in Sungai Sat is probably due to its slightly higher temperature (± 23.26) than in Sungai Kelapah (± 20.72).

Certain fish species are highly adapted morphologically and behaviorally, such as evolving their body forms and mouth structures in order to seek suitable habitats and to feed on available resources (Gorman & Karr, 1978). Fishes display behavioral as well as anatomical adaptations to withstand the force of current (Allan, 1995). Fast-swimming fishes and fishes that could adapt the fast current generally are streamlined and rounded in cross-section. Most species found in Sungai Sat, the stream with a stronger water current, are streamlined fishes especially the cyprinids. Fishes with flattened lateral region such as *Channa* spp. are less suitable to fast currents. Bottom-dwelling fishes such as *Acrochordonichthys* spp. have outspread pectoral fins which aid in holding the fish in place by friction and act as hydrofoils, using the force of current to press the bodies against the substrate (Allan, 1995).



Figure 3 *Syncrossus hymenophysa* (Bleeker, 1852), locally known as Lali is common in TNNP but not widely spread in other localities.

CONCLUSION

The diversity of freshwater fish in Sungai Sat and Sungai Kelapah is low. In this study, it is observed that the distribution and richness of the freshwater fish are affected by the domination of certain species such as *L. rhabdoura*, physical characteristics of the sampling sites and physico-chemical parameters of the water. It is hoped that in the future, more temporal and spatial studies can be conducted to assess the ecological factors influencing fish assemblages, richness, and status in other tributaries in TNNP. It is also hoped that the Department of Fisheries can collaborate with DWNP, in the conservation of the Near Threatened species found in TNNP.

ACKNOWLEDGEMENTS

We would like to express our deep gratitude to the DWNP for the opportunity to join the 2015 Biodiversity Inventory Programme and for the technical aid provided during the specimen collections in Kuala Kelapah, TNNP, Kuala Tahan.

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