

Ecological study of fishes in a small tropical stream (Sungai Kanching, Selangor, Peninsular Malaysia) and its tributaries

Mohd. Zakaria-Ismail and Basir Sabariah

Department of Zoology, University of Malaya, 59100 Kuala Lumpur, Malaysia

ABSTRACT This paper presents the diversity and abundance of fishes in the Sungai Kanching and its tributaries, a second to fifth-order tropical stream. Fifteen species representing 8 families are found in the area. Ichthyofaunal composition is relatively diverse with an average Shannon-Weiner diversity index of 1.14. Standing biomass and number of individuals per m² are 5.3 g and 0.4 individuals, respectively. *Poropuntius smedleyi*, locally known as *ikan daun*, dominates the sampling sites not only in number but also in weight. Members of the Cyprinidae are the most common and abundant in the area. Early findings suggest that tropical streams which have been slightly disturbed may experience a reduction of standing biomass but not its species diversity.

ABSTRAK Makalah ini memaparkan keanekaan dan kelimpahan ikan di Sungai Kanching serta anak-anak sungainya yang berorder ke-2 hingga ke-5. Lima belas spesies yang merangkumi 8 famili ikan terdapat di kawasan kajian. Komposisi iktiofauna kawasan ini agak tinggi dengan purata indeks kepelbagaian Shannon-Weiner sebanyak 1.14. Biomassa tegakan dan bilangan individu untuk 1 m² masing-masing 5.3 g dan 0.4 individu. *Poropuntius smedleyi*, yang dikenali sebagai *ikan daun*, adalah spesies ikan yang paling dominan bukan sahaja dari segi jumlah individu tetapi juga berat. Spesies-spesies ikan Cyprinidae merupakan kumpulan yang paling dominan. Penemuan awal menunjukkan anak-anak sungai di kawasan tropika yang mengalami tahap gangguan yang agak minima akan mengalami pengurangan dari segi biomassa tegakan. Bergantung kepada tahap gangguan yang dialami oleh anak-anak sungai tersebut, keanekaan ikan mungkin tidak berubah.

(ecology, stream, fish, Cyprinidae, diversity)

INTRODUCTION

Freshwater fishes in the tropics are extremely diverse. There are more than 1300 species each in the Amazon and Congo river basins as compared to 250 in the Mississippi River and 190 species in Europe. In the South-East Asian tropics, Zakaria-Ismail [1] estimated the occurrence of more than 1000 species. The majority of these fishes are members of the Cyprinidae.

Although the actual number of fishes in the freshwater habitats of Peninsular Malaysia is not known, it is reasonable to accept that some 200 species occur in the area [2]. Many new species and new records are being

added to the list [3, 4], and the total number of the species could reach 250. Since Peninsular Malaysia is an area of overlap between the Thai and Indonesian elements, a relatively high diversity of freshwater fishes in its aquatic habitats is to be expected

Ichthyological studies in Malaysia have been limited to faunal survey, discovering new records as well as new species. Ichthyofaunal surveys have been very localized and not comprehensive, such as the ichthyofauna of Tasik Bera [5], Taman Negara [6], Endau-Rompin [7, 8], Bukit Rengit [9] and the north Selangor peat swamp forest [10]. A comprehensive survey of the fish fauna in all major river basins in Peninsular Malaysia, such as Pahang, Bernam and Rompin rivers, have recently been started. Although it would take years for the survey to be completed, early observations suggest that the river systems of Peninsular Malaysia are extremely rich in fish life.

Ecological studies on fishes in the freshwater ecosystem in Malaysia are even more scanty. The only intensive and quantitative study was conducted by Bishop [11] in the Sg. Gombak, a small, no larger than 10th order stream, in Selangor. Stream gradients and orders play a major role in the longitudinal distribution of fishes. Of the 27 species he recorded, only five species occur in montane parts of the stream.

The present study deals with the pattern of distribution and diversity of fishes in a small tropical stream. Ecological aspects, such as the influence of habitat structure on species composition, standing biomass and species richness are investigated. These aspects are vital in the understanding of fish community structure in this fast-changing ecosystem.

MATERIALS AND METHODS

Studies were conducted on the Sg. Kanching and its tributaries near Templer's Park (Fig. 1) between August and November 1993. Five sites, on the basis of the presence of multiple microhabitats, were selected for

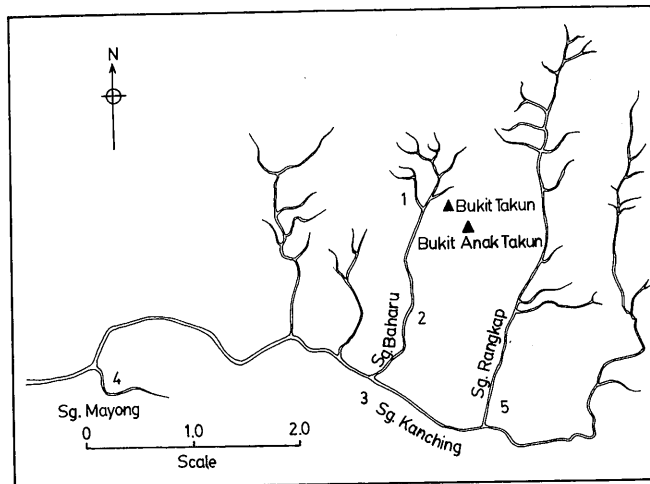


Figure 1. Five sampling sites (1, 2, 3, 4 & 5) of the Sungai Kanching and its tributaries. Bukit Takun and Bukit Anak Takun are two limestone outcrops. The abbreviation "Sg." refers to Sungai meaning a river or a small stream.

quantitative sampling. We used second to fifth-order streams based on the classification of Strahler [12]. Sites 1 and 4 were second order streams with minimum disturbance, while sites 2, 3 and 5 passed through various kinds of land development, such as golf course, building construction, grazing and equestrian centre.

Fish were caught using electroshocker Smith-Root Model 12 in the five sampling areas. In each site, a seine was used to block the upstream and downstream sections of the site to prevent the fish from escaping. The specimens were exhaustively fished from the blocked portion of the stream, which was normally achieved after the third shocking. The interval between shockings was 30 minutes. The surface area of the blocked portion of the stream was determined following Wetzel and Likens [13].

All specimens were immediately fixed in 10% formalin. After 14 days, they were soaked in water for 3 days, blotted dry and weighed collectively within species groupings to the nearest 0.1 g. A Shannon-Weiner diversity index [14] was used to compare diversity of the five sampling areas. In order to detect similarity in terms of species compositions among all sites, Schoener's similarity index [15] was used.

Several selected physical and chemical characteristics were measured. Unless otherwise stated, the procedures recommended by the Standard Methods [16] were used. The parameters included temperature, surface velocity, total dissolved solid, dissolved oxygen and pH. A YSI Model 58 oxygen meter was used to measure dissolved oxygen and temperature. The surface velocity was determined following the standard procedure as suggested by Wetzel and Likens [13]. Ten replicates were made for each parameter and these readings were recorded for the duration of four months between August and November. Data were analysed by using the SAS statistical package on personal computer.

RESULTS AND DISCUSSION

Table 1 indicates the physical and chemical characteristics of the study area. The average dissolved oxygen concentration in sites 1, 2 and 4 was higher than sites 3 and 5 ($P < 0.01$), while sites 2, 3 and 5 had higher temperature than sites 1 and 4 ($P < 0.01$). The surface velocity ranged between 0.2 and 0.5 $m s^{-1}$ and was very similar ($P > 0.05$) in all the study areas. The total dissolved solid seemed to be similar in four areas except site 1 which had the lowest value ($P < 0.01$). The low temperature and total dissolved solid readings (Table 1) were due to the nature of the sites which were very much

Table 1. Mean and standard deviation (\pm) of the five selected physical and chemical characteristics of the sampling sites. Observations were based on 10 replicates. Sites 1 and 4 were second order streams while sites 2, 5 and 3 were third, fourth and fifth order streams respectively.

	Sampling Sites					P-value
	1	2	3	4	5	
Dissolved oxygen (mg/L)	8.3 \pm 0.32	8.5 \pm 0.53	7.5 \pm 0.68	8.4 \pm 0.54	7.7 \pm 0.42	< 0.01
Temperature ($^{\circ}C$)	23.9 \pm 0.32	26.7 \pm 1.76	27.6 \pm 1.61	24.7 \pm 0.42	27.8 \pm 0.41	< 0.01
Surface velocity (m/s)	0.3 \pm 0.10	0.2 \pm 0.04	0.5 \pm 0.06	0.5 \pm 0.13	0.5 \pm 0.05	> 0.05
pH	7.2 \pm 0.34	7.7 \pm 0.53	6.9 \pm 0.30	6.9 \pm 0.34	6.5 \pm 0.06	> 0.05
Total dissolved solid (mg/L)	9.2 \pm 0.29	43.2 \pm 3.14	57.3 \pm 6.21	38.4 \pm 9.04	43.4 \pm 13.30	< 0.01

undisturbed, surrounded by secondary as well as some patches of primary forest. These patterns of water quality are similar to the one observed by Bishop [11].

A total of 15 species representing 8 families of fish were recorded from the study area (Table 2). This number is similar to the findings of Zakaria-Ismail and Siti-Baizura [17] in their study of Sg. Jerneh, Kerling, Selangor but much less than the one recorded by Bishop [11] for Sg. Gombak. This is expected because the study area is of a smaller order stream (order 2-5) as compared to the 1-10th order stream of Sg. Gombak. Nevertheless, the area is relatively diverse with fish life.

Table 2. Number of individuals and biomass (g) for all fish collected in the five sampling sites. Species are listed by rank order of numerical abundance. Values in brackets are rank of species based on biomass.

Species	Family	Number	Biomass
<i>Poropuntius smedleyi</i>	Cyprinidae	136	2240.8 (1)
<i>Mystacoleucus marginatus</i>	Cyprinidae	58	1402.0 (2)
<i>Neolissochilus soroides</i>	Cyprinidae	35	461.1 (3)
<i>Rasbora sumatrana</i>	Cyprinidae	32	254.8 (4)
<i>Puntius binotatus</i>	Cyprinidae	16	224.4 (5)
<i>Betta pugnax</i>	Belontiidae	7	13.1 (11)
<i>Puntius partipentazona</i>	Cyprinidae	7	3.4 (13)
<i>Clarias teijsmanni</i>	Clariidae	4	146.9 (8)
<i>Channa striata</i>	Channidae	4	208.4 (7)
<i>Oxyeleotris marmorata</i>	Eleotrididae	4	213.6 (6)
<i>Parambassis punctulata</i>	Chandidae	3	1.0 (15)
<i>Esomus metallicus</i>	Cyprinidae	2	2.9 (14)
<i>Monopterus albus</i>	Synbranchidae	2	27.2 (9)
<i>Channa gachua</i>	Channidae	1	7.4 (12)
<i>Macrognathus maculatus</i>	Mastacembelidae	1	15.7 (10)
Total		312	5222.7

Poropuntius smedleyi, locally known as *ikan daun*, was the most dominant species in all sites, not only in terms of number but also in biomass (Table 2), followed by *Mystacoleucus marginatus* (*ikan sia*), *Neolissochilus soroides* (*ikan tengas*), *Rasbora sumatrana* (*ikan seluang*) and *Puntius binotatus* (*ikan tebal sisik*). Although only four specimens each for the catfish (*Clarias teijsmanni*), the snakehead (*Channa striata*) and the eleotrid (*Oxyeleotris marmorata*) were caught during the study, they occupied the 6th, 7th and 8th positions in terms of biomass, respectively. On the whole, a total of 312 individuals and some 5222 g of fish was collected during the study (Table 2).

Members of the Cyprinidae dominate the fish fauna, comprising of about 47% of the total species composition (Fig. 2). The dominance of the cyprinoid fishes worldwide, except in South America, Iceland and Australia, has been noted by many investigators [18, 19]. Since the cyprinids are the most common and abundant group of freshwater fishes in South-East Asia [20, 21], high diversity of the group is also expected in the study area. Zakaria-Ismail [1] noted that in a stream which has not been badly disturbed, the cyprinid fishes might comprise of more than 50% of the total ichthyofaunal diversity; however, this percentage is lower in a disturbed aquatic environment. The occurrence of this group of fish in the study sites suggests that the stream has already been partly disturbed.

In terms of species composition, site 1 was very similar to site 2 with the highest value of Schoener's

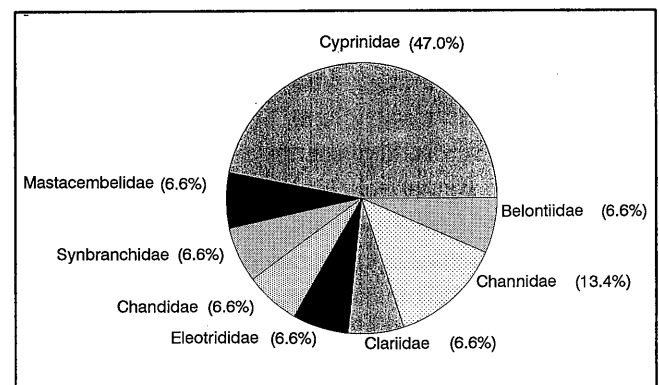


Figure 2. Fish family composition in all of the sampling sites. The number of species for each family is given in terms of percentage.

Table 3. Similarity in species composition between two sites based on Schoener similarity index. A value of 1 indicates an identical species composition between the two sites, while a value of 0 shows species of both sites are totally different.

Sampling Sites	Schoener Similarity Index
1 and 2	0.76
2 and 4	0.56
1 and 5	0.47
2 and 3	0.42
3 and 4	0.42
1 and 4	0.37
3 and 5	0.36
2 and 5	0.32
1 and 3	0.30
4 and 5	0.18

Table 4. Surface area, number of species, biomass, number of individuals, number/m², standing biomass and Shannon-Weiner diversity index of the study area.

	Sampling Sites					Range	Mean ± S.D
	1	2	3	4	5		
Surface area (m ²)	56.8	220.8	385.6	76.0	100.8	56.8 - 385.6	-
Number of species	5	8	6	4	4	4 - 8	-
Biomass (g)	180.0	1134.1	2977.5	344.0	587.1	180.0 - 2977.5	-
Number of individuals	17	100	129	26	40	17 - 129	-
Number/m ²	0.3	0.5	0.3	0.3	0.4	0.3 - 0.5	0.4
Standing Biomass (g/m ²)	3.2	5.1	7.7	4.4	5.8	3.2 - 7.7	5.2 ± 1.7
Shannon-Weiner's index (H')	1.48	1.35	1.16	0.51	1.19	0.51 - 1.48	1.14 ± 0.37

index of similarity (Table 3). Since both sites were adjacent to each other, this pattern of species composition is expected. The species composition was least similar between sites 4 and 5, because they were far apart and of different order. Preliminary findings suggest that proximity and stream orders play a major role in determining similarity of species composition.

On the whole, the study area supported an average of 5.2 g and 0.4 individuals per m² (Table 4) as compared to 9.0 g and 1.6 individuals per m² reported by Zakaria-Ismail and Siti-Baizura [17] in their study of Sg. Jerneh, Selangor. Low productivity observed in the study area is probably attributable to the fact that the area has been very much disturbed as compared to Sg. Jerneh which is running through a secondary forest which has been left undisturbed for more than 40 years. On the other hand, the Shannon-Weiner index of diversity is higher in the present study than that for Sg. Jerneh (1.14 vs 0.8). This is expected because Sg. Kanching and its tributaries are much bigger rivers with a greater variety of habitat structure. As a whole, early findings suggest that tropical streams which are slightly disturbed might have lower standing biomass but can still harbour a high diversity of fish life provided that the variety of habitat structure is still present in the area.

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