

RESEARCH NOTE

SMALL STREAMS ICHTHYOFAUNA OF WESTERN LANGKAWI ISLAND, MALAYSIA

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A number of collections on fish fauna were conducted in Langkawi island with earliest by Tweedie (1936) and most recent by Izzati and Samat (2010). Forty-one fish species are known from the streams of the island out of which 24 species are considered primary freshwater fishes including three introduced species (*Oreochromis mossambicus*, *Carassius auratus auratus* and *Trichogaster pectoralis*) (Amirrudin & Lim 2006; Izzati & Samat 2010).

Island streams are commonly comprise of a significant portion of secondary besides the primary freshwater fishes (Ng *et al.*, 1999; Tan & Lim 2004; Amirrudin *et al.*, 2006) especially when the sampling took place within the area that is influenced by tides. However, the types of species that occur may differ for different locations in the islands although they are within the same geographical region. This study highlights the diversity and growth condition of primary freshwater fish of several small upper streams in the western part of Langkawi island. Ecologically, it is important to distinguish between primary and secondary freshwater fish community because they are different in structure and function, and in the small upper streams fishes are very sensitive to habitat alteration. The western part of Langkawi was chosen due to two reasons. Firstly, this area has a unique geographical feature that according to Jones (1978) is originated from a single land formation of Cambrian age. Secondly, lesser development occurred in the area compared to other parts of the island. Therefore, documenting fundamental information on the ichthyofauna of the area is very important in terms of conservation.

The study was conducted during August until November 2007. There were six streams surveyed namely Datai, Temurun, Cina, Lenggara Perangin and Kubang Badak streams. The sampling sites at

these streams were tagged as S01 to S06 (Figure 1). All sites were shallow enough (depth < 1 m) to be easily sampled by wading. A backpack electrofisher (Model LR-20 with a node ring of approximately 30 cm of diameter) was used to assist fish sampling in an upstream direction, following the CEN standards EN 14962 and EN 14011 (Simonson & Lyons 1995; Dunham *et al.*, 2002; Benejam *et al.*, 2012). Electrocutted fishes were collected using scoop and hand nets. The fishes caught were released back to the stream immediately after their identity was confirmed and the total length and weight measurements were taken. The fish specimens were identified following Kottelat *et al.* (1993) and Rainboth (1996) methods.

In this study, the species diversity of fish was indicated by the Simpson Index (Magurran 1988) represented as $D_s = 1 - [\sum n_i (n_i - 1)] / [N(N-1)]$. The evenness of distribution was presented by the Evenness Index (Magurran 1988) where by $E_s = D_s / D_{max}$. Growth parameter data of two abundant species captured, namely *Puntius binotatus* and *Devario regina* was manipulated through length-weight analysis ($W = aL^b$) to bring a general picture on their well-being condition in the local habitat (Pauly 1984; King 1996; Jones *et al.*, 1999). Origin version 6.0 statistical software was used to analyze the data.

A total of 16 species and 9 families of stream fishes were collected during this survey (Table 1). Species diversity of fish among the streams surveyed varied and its value ranged between 0.376 and 0.793. Evenness index ranged from 0.493 to 0.820. The highest species richness was recorded in Kubang Badak stream with 8 species while the lowest was recorded in Temurun stream with 3 species.

The fish community in the area was dominated by cyprinids, which comprised 43.8% of the total

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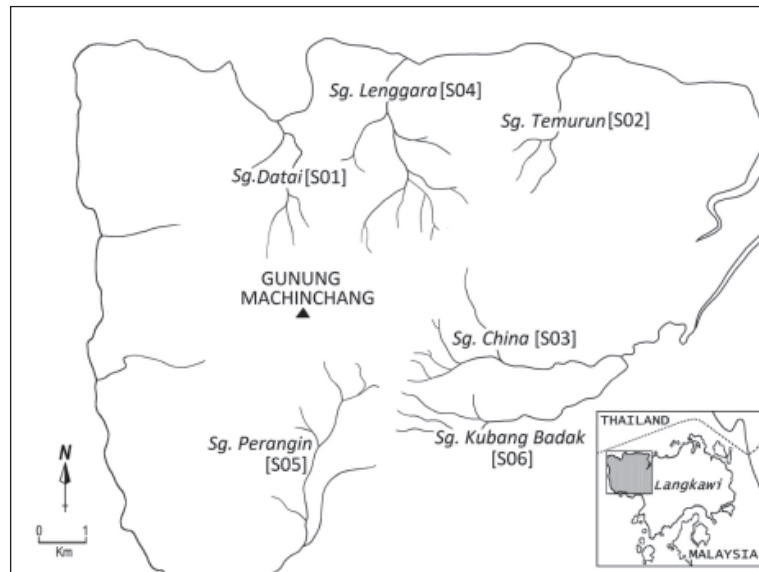


Fig. 1. Map showing the sampling sites in the Western part of Langkawi island

Table 1. The presence (+) and absence (–) of fish species in the six investigated streams, namely Datoi (S01), Temurun (S02), Cina (S03), Lenggara (S04), Perangin (S05), and Kubang Badak (S06)

Scientific Name	Stream					
	S01	S02	S03	S04	S05	S06
Family: Cyprinidae						
01. <i>Devario regina</i>	+	+	+	+	+	–
02. <i>Danio albolineatus</i>	+	+	–	+	+	+
03. <i>Neolissochilus shendersoni</i>	+	–	–	–	–	–
04. <i>Cyclocheilichthys apogon</i>	–	–	–	–	–	+
05. <i>Rasbora paviana</i>	–	–	–	–	–	+
06. <i>Puntius binotatus</i>	–	–	+	–	+	+
07. <i>Carassius auratus auratus</i>	–	–	–	+	–	–
Family: Osphronemidae						
08. <i>Betta pugnax</i>	+	–	+	+	+	–
Family: Aplocheilidae						
09. <i>Aplocheilus panchax</i>	–	–	–	–	–	+
Family: Balitoridae						
10. <i>Schistura robertsi</i>	+	–	–	–	–	–
Family: Anabantidae						
11. <i>Anabas testudineus</i>	–	–	–	–	–	+
Family: Bagridae						
12. <i>Batasio havmolleri</i>	–	–	+	–	–	–
Family: Andrianichthyidae						
13. <i>Orizias javanicus</i>	–	–	–	+	–	–
Family: Channidae						
14. <i>Channa gachua</i>	–	–	–	–	–	+
15. <i>Channa striata</i>	–	–	+	–	–	+
Family: Siluridae						
16. <i>Silurichthys schneideri</i>	–	–	+	–	–	–
Total no. of species (N)	05	02	06	05	04	08
Simpson Index (D_s)	0.648	0.482	0.766	0.657	0.376	0.793
Evenness of Distribution (E_s)	0.669	0.983	0.820	0.699	0.493	0.719

number of the fishes recorded followed by channids (12.5%). Other families were represented only by a single species (6.3%), respectively. Within the Cyprinids, *Devario regina* (28.5%) occurred in greater abundance than the other species in the family followed by *Puntius binotatus* (17.1%) and *Danio albolineatus* (11.79%).

On the other hand, *Neolissochilus hendersoni*, *Schistura robertsi*, and *Batasio havmolleri* were not widely distributed in the island. Only a single individual was caught for each of these species. For example, *Schistura robertsi* (Family: Balitoridae) was only found in Datai stream. A sample of this species was also reportedly found by Amirrudin and Lim (2006) at Lenggara stream. It was previously reported to be known only from Peninsular Thailand and Phuket island (Kottelat 1990), and Langkawi island (Lim & Tan 2002). *Neolissochilus hendersoni* is claimed to be an island endemic species (Amirrudin & Lim 2006) as it was only recorded in Penang island (Alfred 1963) and in Tioman island (Ng *et al.*, 1999).

In this study, only the primary freshwater species were recorded. They have no or very little salt tolerance and are confined to freshwater habitat (Zakaria-Ismail 1994). Catfishes are among the most diverse groups of freshwater fishes in Peninsular Malaysia in terms of numbers and families (Lee & Zakaria-Ismail 1996). However, the only members of the family of Siluridae (*Silurichthys schneideri*) and Bagridae (*Batasio havmolleri*) were recorded in Langkawi island.

Shallow water (depth < 0.3 m) with gravel and pebble bottoms and strong current represents favorable condition for small fishes

such as *Devario regina*, *Schistura robertsi* and *Danio albolineatus*. *Puntius lateristriga* and the juvenile of *Neolissochilus hendersoni* were also found in the upper streams especially in the riffles. Deeper water (up to 1m) with sandy bottoms was commonly preferred by *Cyclocheilichthys apogon*, *Rasbora paviana*, *Puntius binotatus* and *Silurichthys schneideri*. While *Batasio havmolleri*, *Channa gachua* and *C. striata* were the species recorded in the slow moving water section, *Rasbora paviana* is the species that was easily seen in sub-surface layer of the water. *Betta pugnax* also shared the same stratum but were more frequently found in the pool. *Puntius* and *Cyclocheilichthys* seem to occupy various strata but mainly stay at the middle strata with *Devario regina*, and *Danio albolineatus*. These vertical distributions were mainly associated with the fish foraging activity.

The estimated values of b was close to 3.0 showing negative allometric growth for *Puntius binotatus*, and higher than 3.0 for *Devario regina* showing a positive allometric growth (Table 2). The results suggested that both species (Figure 2) have gone through a normal growth process in their habitat. The similar growth patterns are also may be applies to other fishes that shared the same habitat. It is because healthy fishes generally have values of b between 2.5 and 3.5 (Bagenal & Tesch 1978; King 1996). Naturally, the parameter b may vary seasonally, daily, or between habitats. Thus, the length-weight relationship in fish is affected by a number of factors including gonad maturity, sex, and stomach fullness, none of which were taken into account in the present study.

Table 2. The growth parameters of *Puntius binotatus* and *Devario regina* based on length-weight analysis

Species name	N	Statistics			
		b	a	χ^2	r^2
<i>Puntius binotatus</i>	49	2.992±0.050	0.013±0.014	0.121	0.989
<i>Devario regina</i>	52	3.059±0.075	0.008±0.001	0.167	0.981

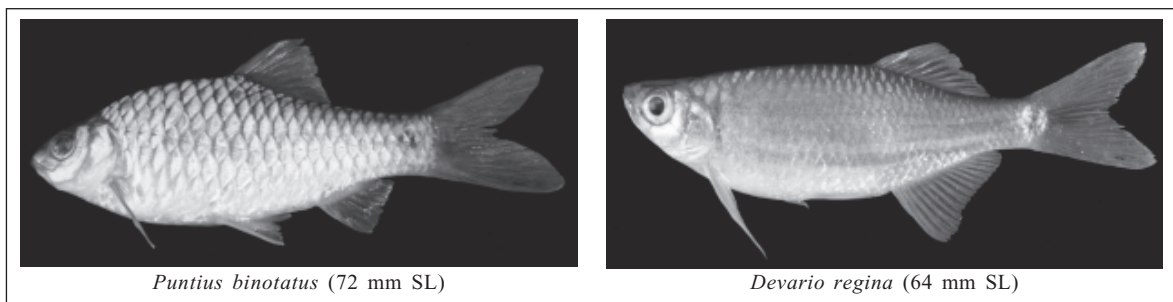


Fig. 2. The two represented species of freshwater fish caught used to indicate the suitability of the habitat condition of their habitat based on growth parameter, SL = standard length

In conclusion, the results of our study show that small freshwater streams of western Langkawi island was dominated by cyprinid fishes. The fish diversity varied between streams and they seem to have no threats occurred against their growth.

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