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A preliminary study on ichthyofaunal diversity of Lata Keding, Jeli, Kelantan, Malaysia

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Abstract : A preliminary study on the ichthyofaunal diversity of Lata Keding, Jeli in Kelantan, Malaysia was conducted from 19th March to 22nd April 2022. The main objective of this study is to evaluate and document the diversity of fish species (ichthyofauna) in the study area. Fish were collected along Lata Keding at seven sampling points using fishing nets, resulting in a total of 128 individuals belonging to nine species from four families being identified. The families represented were Cyprinidae, Bagridae, Botiidae and Channidae, with the Cyprinidae family comprising the majority of the catch at 91%. This was followed by Bagridae (4%), Botiidae (3%) and Channidae (2%). The nine identified species were *Poropuntius normani*, *Mystacoleucus obtusirostris*, *Ceratogarra cambodgiensis*, *Rasbora paviana*, *Osteochilus waandersii*, *Barbodes rhombeus*, *Channa limbata*, *Syncrossus beauforti* and *Batasio fluviatilis*. This study showed that *C. cambodgiensis* (Siamese Stone Lapping) was the dominant species at all seven sampling points. Furthermore, sampling point G achieved the highest Simpson index and Shannon Wiener index with 0.863 and 2.023, respectively. This study demonstrated that Lata Keding maintains a diverse population of fish, demonstrating favourable water quality and environmental conditions of the river.

Keywords: Diversity, evenness index, ichthyofaunal, Simpson's Diversity index, Shannon Wiener index

INTRODUCTION

Diversity comes in three forms: ecosystem, species, and genetic. Ecosystem diversity means the variety of habitats, tiny organisms, and natural processes in both land and water, along with how these systems work and connect. Species diversity counts how many different kinds of living things are on Earth. Genetic diversity is the differences within and between groups of one species, measured by variations in genes (The MEA Project Team 2007). While water covers approximately 70% of the Earth's surface, but not all water is freshwater; only 3.5 % consist of freshwater, while the remaining 96.5 % is salty ocean water. Freshwater can be found in ponds, lakes, streams, and frozen water, in addition to oceans and seas.

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In Peninsular Malaysia, the Department of Irrigation and Drainage (2017) recorded approximately 150 river systems. Malaysian rivers are not only home to a diverse range of flora and fauna but also provide excellent recreational opportunities. Malaysia boasts a rich diversity of wildlife, including a wide array of fish species, thriving in both freshwater and marine habitats from the Malay peninsula to its surrounding islands and beyond. Specifically, freshwater fishes are most abundant in Malay lakes, rivers, and streams. Malaysians rely on the aquatic environment and its resources for food, water, medicine, energy, and transportation, including for domestic, agricultural, and industrial purposes. However, this vital environment, which provides essential benefits for human life, is currently facing threats and will cease to function as an important resource, if left unchecked. These aquatic habitats are being degraded, both inland and at sea, due to the direct and indirect effects of unsustainable economic development (Yusoff *et al.* 2006).

Fish can be found in virtually every body of water in the world, in almost every type of aquatic environment – from the deepest parts of the ocean to mountain streams. According to Kiprop (2020), there are approximately 33,600 fish species that had been recorded. Globally, humans rely on fish as a food source. They have also held cultural significance since the ancient period, representing religious symbols, deities, and serving as subjects in various forms of art and literature.

Lata Keding stands out as a popular destination for local and international tourists. Despite some limited research conducted at Lata Keding, there is a lack of documented information regarding the diversity and abundance of fish at the river. Therefore, this study represents the first investigation into the fish diversity at Lata Keding.

MATERIALS AND METHODS

The preliminary study was conducted at Lata Keding, Jeli in Kelantan between 19th March to 22nd April 2022. The study utilised the line-transect method, covering a distance of approximately 1.5km from upstream to downstream. Seven sampling points were selected with the random distances between them to ensure that this study is statistically robust (Figure 1). These sampling points were strategically chosen in quiet environments to minimise disturbance to fish presence. Fish, like many animals, can be sensitive to disturbances in their environment, such as noise or human presence. By selecting quiet areas for sampling, the likelihood for fish presence is higher. The sampling points were also selected in areas that are less rocky and have deep water to facilitate net usage. The main fishing gear employed to capture fish were scoop net and fishing net (mesh size of 0.5 inch). The collected fish were photographed, and measured for length and width using a ruler, before being released back into the river. Fish identification was conducted using *Fishes of the Freshwater Ecosystems of Peninsular Malaysia* by Zakaria-Ismail *et al.* (2019). Data on fish caught during the sampling period were analysed using biodiversity indices such as Simpson's index, Shannon's index, and Evenness index.

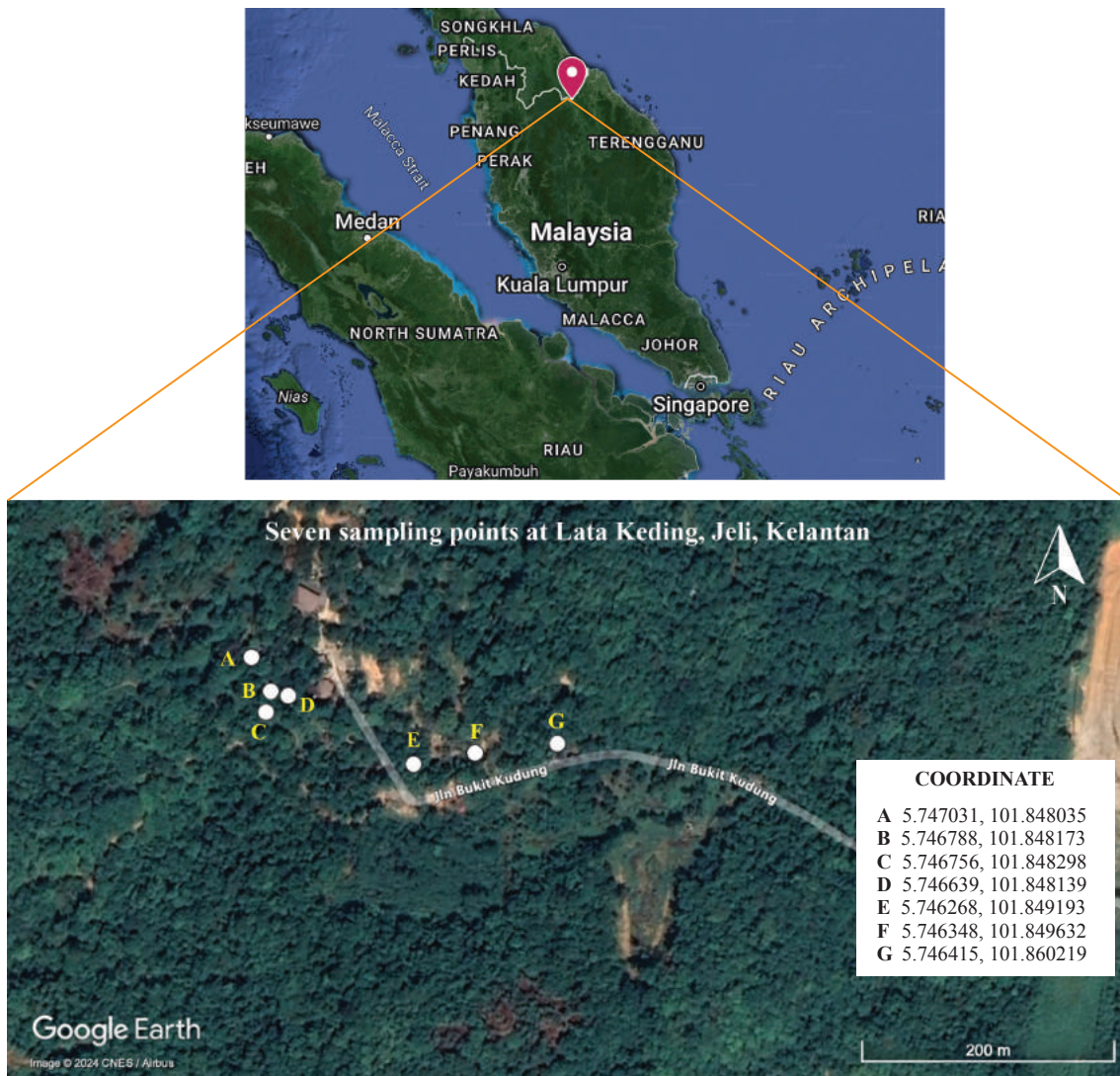


Figure 1. Map that display the points of sampling at Lata Keding, Jeli, Kelantan.

RESULTS AND DISCUSSION

A total of 128 individuals of native freshwater fishes were collected from seven sampling points in Lata Keding, Jeli, Kelantan. These individuals were identified into four families, namely Cyprinidae, Channidae, Botiidae and Bagridae. The nine distinct species include *Poropuntius normani*, *Mystacoleucus obtusirostris*, *Ceratogarra cambodgiensis*, *Rasbora paviana*, *Osteochilus waandersii*, *Barbodes rhombeus*, *Channa limbata*, *Syncrossus beauforti*, and *Batasio fluviatilis*.

Analysis of the study data displayed that sampling point A has the highest species richness, with all nine species, while sampling point F has the lowest number of fish species (Table 1). The predominant species across all sampling points were *C. cambodgiensis* (Siamese Stone Lapping). *Poropuntius normani* was the largest species observed, measuring 18.2 cm in length, compared to other fish species identified in Lata Keding.

Table 1. Freshwater fish occurrences at seven sampling points at Lata Keding, Jeli, Kelantan.

No.	Family	Fish Species	Common Name (English)	Common Name (Malay)	Point							
					A	B	C	D	E	F	G	
1.	Cyprinidae	<i>Poropuntius normani</i>	Barb	Tengas Daun	+	+	+	+	+	+	+	+
2.		<i>Mystacoleucus obtusirostris</i>	Blunt-snout Barb	Sia/Kepiat	+	+	+	+	+	+	+	+
3.		<i>Ceratogarra cambodgiensis</i>	Siamese Stone Lapping	Susur Batu	+	+	+	+	+	+	+	+
4.		<i>Rasbora paviana</i>	Sidestripe Rasbora	Seluang Jalur Sisi	+	+	+	+	+	+	+	+
5.		<i>Osteochilus waandersii</i>	Waandersii's Hard Lipped Barb	Rung	+	+	+	+	+	+	+	+
6.		<i>Barbodes rhombeus</i>	Spotted Barb	Tebal	+	+	+	+	+	+	+	+
7.	Channidae	<i>Channa limbata</i>	Dwarf Snakehead	Sisik/Putih Haruan Kedak	+				+			
8.	Botiidae	<i>Syncrossus beauforti</i>	Chameleon Loach	Lali Babi	+				+			+
9.	Bagridae	<i>Batasio fluviatilis</i>	Catfish	None	+							+
Total					9	6	5	5	6	4	4	7

"+" = Occurrence.

Based on Figure 2, the highest percentage of catch were observed at sampling points C and F, each accounting for 18% of the total catch with 23 individuals. These sites were characterised by greater depth compared to other sites. Meanwhile, sampling point E recorded the lowest catch, with only 13 individual (10%) due to the rocky terrain at this site and can be shallow and dry during sunny days. Besides, the site was also situated along the main road leading to the Lata Keding Chalet and campsite.

The study found that the family of Cyprinidae was the most abundant at Lata Keding, Jeli, Kelantan, with 117 individuals (91%), and across all seven sampling points. This study aligns with most studies on freshwater fish in Malaysia, which consistently identified Cyprinidae as the highest percentage of catches in freshwater habitats (Lee *et al.* 2013; Ismail *et al.* 2013; Nurul *et al.* 2016; Farinordin *et al.* 2016; Alias *et al.* 2019). According to Ambak *et al.* (2012), Cyprinidae is the largest family of freshwater fishes. In Malaysia, it is considered to be the most diverse genera and species, as well as the most abundant in rivers and lakes. In addition, most Cyprinidae are riverine and spawn in the first rainy season after a long period of drought as they exhibit various spawning habits (Ambak *et al.* 2012). The second dominant family was Bagridae with 5 individuals (4%), followed by Botiidae with 4 individuals (3%) and Channidae with 2 individuals (2%) (Figure 3).

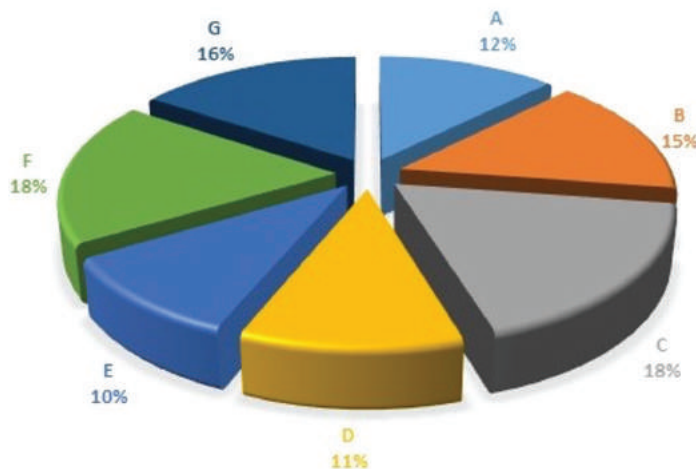


Figure 2. Percentage catchment of freshwater fish at seven sampling points.

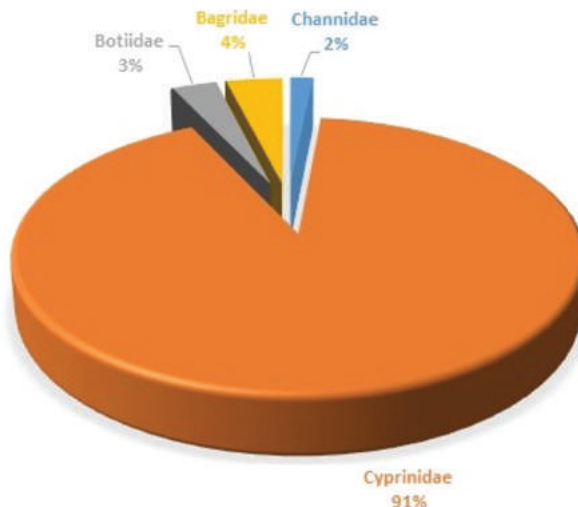


Figure 3. Percentage composition of different freshwater fish families of Lata Keding, Jeli, Kelantan.

Table 2. IUCN status of freshwater fish species at Lata Keding, Jeli, Kelantan.

No.	Family	Fish Species	Common Name (English)	Common Name (Malay)	IUCN
1.	Cyprinidae	<i>Poropuntius normani</i>	Barb	Tengas Daun	LC
2.		<i>Mystacoleucus obtusirostris</i>	Blunt-snout Barb	Sia / Kepiat	LC
3.		<i>Ceratogarra cambodgiensis</i>	Siamese Stone Lapping	Susur Batu	LC
4.		<i>Rasbora paviana</i>	Sidestripe Rasbora	Seluang Jalur Sisi	LC
5.		<i>Osteochilus waandersii</i>	Waandersii's Hard Lipped Barb	Rung	LC
6.		<i>Barbodes rhombeus</i>	Spotted Barb	Tebal Sisik	LC
7.	Channidae	<i>Channa limbata</i>	Dwarf Snakehead	Haruan Kedak	LC
8.	Botiidae	<i>Syncrossus beauforti</i>	Chameleon Loach	Lali Babi	NT
9.	Bagridae	<i>Batasio fluviatilis</i>	Catfish	N/A	LC

The conservation status of all species recorded in this study was assessed using IUCN Red List of Threatened Species. According to Sheikh Abdul Kadir *et al.* (2019), it is important to note that fish species need to be conserved and protected because they serve as important indicators of habitat health and biodiversity. Among the recorded species, eight of them are categorised as least concern (LC), namely *B. fluviatilis*, *C. limbata*, *C. cambodgiensis*, *M. obtusirostris*, *O. waandersii*, *B. rhombeus*, *P. normani*, and *R. paviana*. Only one species is classified as near threatened (NT), which is *S. beauforti*. Nevertheless, it is imperative that these species need to be conserved due to their importance and respective roles in the environment, as well as their status as native species in the country.

1. *Batasio fluviatilis* (Day 1888)

Remarks. Catfish (*Batasio fluviatilis*) from family Bagridae were caught at Points A and G. The site is also located nearby a clearing by human activities. According to Ahmad *et al.* (2018), this species were formerly known as *Batasio havmolleri* (Smith 1931). *Batasio fluviatilis* is recorded in Malaysia, Thailand, and Myanmar (Ahmad *et al.* 2018). They occur in streams that have moderate to heavy currents and rocky bottoms, and are less common in slow-flowing and muddy substrates (Ahmad *et al.* 2018). During the day, they tend to hide between stones and aquatic vegetations, and become more active at night to feed (Ahmad *et al.* 2018).

2. *Syncrossus beauforti* (Smith 1931)

Remarks. ‘*Lali babi*’ or common name Chameleon Loach is found in small and medium-sized rivers in northern Thailand and Peninsular Malaysia (Rainboth 1996). This species is known to burrow in sand and hole under rocks (Rainboth 1996).

3. *Channa limbata* (Cuvier 1831)

Remarks. *Channa limbata* or its local name ‘*ikan haruan kedak*’ is distributed in Thailand, Peninsular Malaysia, Singapore, and Indonesia (Nix 2021). This species was discovered by Hamilton-Buchanan, a scientist in Gange River, India, in 1822. Their habitat can be found in forest rivers, shallow swamps, and upland areas up to 3500 meters. They have the ability to withstand hypoxic conditions by utilising atmospheric air for respiration.

4. *Ceratogarra cambodgiensis* (Tirant 1883)

Remarks. Siamese Stone Lapping Minnow or locally known as ‘*susur batu*’, is found in Thailand and Peninsular Malaysia. They typically inhabit in fast-flowing sections of headwater and tributaries, rather than in larger, lowland river channels (Aquadiction 2021).

5. *Barbodes rhombeus* (Valenciennes 1842)

Remarks. The Common barb’s habitat is usually in clear or turbid bodies of water, including fast-flowing, slow-flowing and still waters (Ng *et al.* 2018). Their diet consist of plants, aquatic arthropods, and macroinvertebrates (Ng *et al.* 2018).

6. *Rasbora paviana* (Tirant 1885)

Remarks. Sidestripe Rasbora or locally known as ‘*ikan seluang jalur sisi*’ is a relatively small *Rasbora* that inhabits streams, marshlands, peat swamps, floodplains and rivers (Rainboth 1996; Kottelat 1998). This pelagic moderate-sized minnow normally shoals in small to large river (Zakaria-Ismail 2019). In the Mekong basin, particularly at Khone falls, it has been reported that *R. paviana* was most abundant during the dry season, while it exhibits a slight increase at the onset of the rainy season (Baran *et al.* 2005). *Rasbora* species play important trophic roles as both predator and prey, primarily feeding on small animal matter as pelagic omnivores (Brittan 1972; Ward-Campbell *et al.* 2005).

7. *Poropuntius normani* (de Beaufort 1933)

Remarks. Barb or its local name '*ikan tengas daun*' is found in headwater streams in Peninsular Malaysia (Ng *et al.* 2018). According to Muhammad-Rasul *et al.* (2018), the body of the fish is moderately elongated and compressed, with a slightly pointed snout. Lower mouth, lower jaw shape varies from round to truncated, lower jaw is always lower than the upper jaw. The papules are arranged irregularly from the tip of the snout to the lacrimal bone and can be seen with the naked eye. Some adult breeding males were observed to have widespread tuberculation on the head, back half of the body and anal fin.

8. *Osteochilus waandersii* (Bleeker 1852)

Remarks. *Osteochilus waandersii* is also known as '*ikan rung*' locally (Hui 2009). This species is easily recognised by its prominent black mid-lateral stripe that extends to the posterior end of the caudal-fin rays, red caudal fin, and three tubercles at the tip of the snout, usually on the middle and largest part (Hui 2009).

9. *Mystacoleucus obtusirostris* (Valenciennes, in Cuvier & Valenciennes 1842)

Remarks. *Mystacoleucus obtusirostris* is a barb or minnow species recorded in many parts of Malaysia Peninsular, and can be found in many parts of Southeast Asia, including Borneo, Sumatra, and Java (Ahmad *et al.* 2018). This species inhabits streams with clear and moving waters at lower depths. They are commonly found in habitats containing sand or pebble gravel, usually from small streams to the large rivers (Ahmad *et al.* 2018).

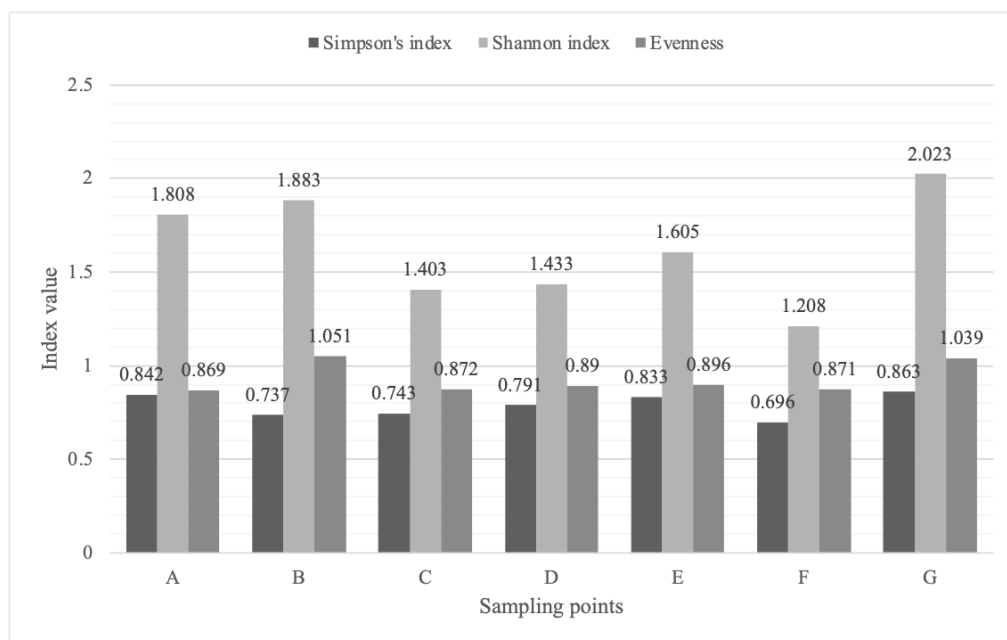


Figure 4. Index value of different indices of freshwater fish at Lata Keding, Jeli, Kelantan.

This study showed that Lata Keding harbours various fish species within its community, with multiple species dominating each specific site. Simpson's index was used to measure the diversity of the fish species present at these sites, as well as the relative abundance of each species. Simpson's diversity index ranges from 0 to 1, with 0 indicating no diversity and 1 representing maximum diversity. From this study, the highest Simpson's index was at sampling point G (0.863), indicating greater diversity compared to other sites (Figure 4). The similar Simpson's index values across the different sites suggested a diverse community of fish in the surveyed area in Lata Keding.

Shannon index (H') was also used to measure the diversity of fish communities of each site at Lata Keding. Based on Figure 4, the sampling point G recorded the highest Shannon index compared to other sites, with a value of $H' = 2.023$. Contrarily, the diversity was recorded at sampling point F ($H' = 1.208$) due to the presence of only four species and one family. A higher Shannon index signifies a more diverse site area, with a healthy environment typically falling within a Shannon index range of 2.5 to 3.5, as suggested by Khan *et al.* (2004). However, it is important to note that the results of this study are preliminary and inconclusive due to the short duration of data collection. Even so, this study showed Lata Keding still harbours various species of fish.

Species evenness displays the distribution of abundance of each species in a community. High evenness indicates that all species are equally abundant in the community, which is important for assessing ecosystem stability. From the study, the highest evenness was observed at sampling point B. Conversely, sampling point A has the lowest evenness due to certain species dominating the site (Figure 4).

The species accumulation curve provides an estimate of the expected number of species or classes in a population based on the sampling effort. This metric can be used to assess and compare the diversity among individuals and determine the benefits of additional sampling (Deng *et al.* 2015). Based on Figure 5, the species accumulation curve did not reach asymptote level. Thus, to gain plateau or asymptote level, the sampling duration and sampling effort should be increased to ensure sufficient data collection.

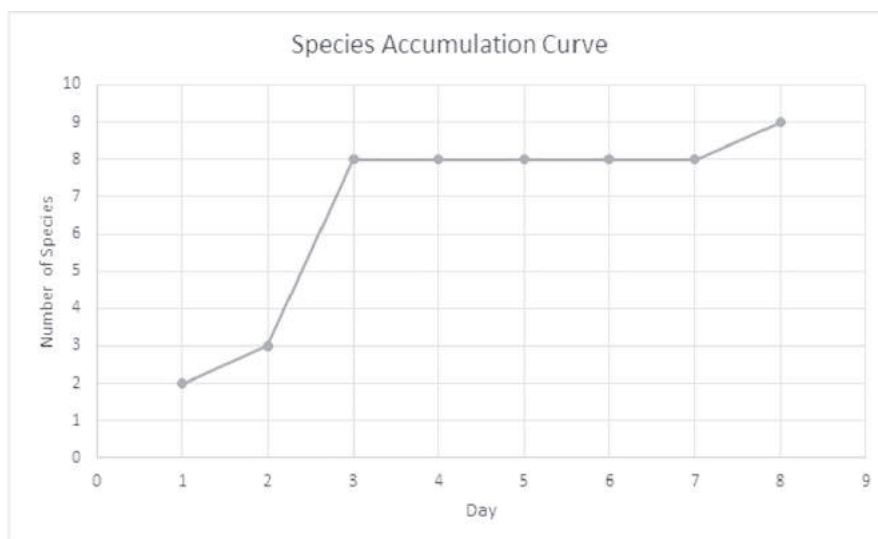


Figure 5. Species accumulation curve of freshwater fish at Lata Keding, Jeli, Kelantan.

CONCLUSION

The results of this study demonstrated the presence of diverse fish species in Lata Keding, Jeli, Kelantan. The dominant species, *Ceratogarra cambodgiensis*, was found at each sampling points. The Cyprinidae family accounted for the highest proportion of catches in Lata Keding, totaling 91.41%. It is recommended that conservation efforts focus on safeguarding near-threatened species, *Syncrossus beauforti*, by ensuring the area remains free from human disturbances and pollution. Awareness programs on the importance of the diversity of freshwater fish species and the conservation and protection of river ecosystems and habitat improvement programs need to be intensified.

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