

## Short Communication: Fish diversity of the Batang Toru River System, South Tapanuli, North Sumatra

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**Abstract.** Roesma DI, Chornelia A, Mursyd A, Kamsi M. 2016. Short Communication: Fish diversity of the Batang Toru River System, South Tapanuli, North Sumatra. *Biodiversitas* 17: 634-641. A rapid survey on fish diversity was carried in the Batang Toru river system. The survey was carried out in the wet season between 8-14 February 2015 and 15-21 of March 2015 along various tributaries on the east (10) and west (1) side of the main Batang Toru river system. We obtained 427 individuals fish samples consisting of 24 species, from 10 families. These consist of Cyprinidae (11 species), Balitoridae (2), Channidae (2), Gobiidae (2), Nemacheilidae (2), Aplocheilidae (1), Bagridae (1), Cichlidae (1), Mastacembelidae (1), and Sisoridae (1). Four Sumatra fish species were encountered during the surveys, namely *Neolissochilus sumatranus*, *Nemacheilus pfeifferae*, *Homaloptera gymnogaster* and *H. heterolepis*. *N. sumatranus* and *Puntius binotatus* were the most frequently found in all of sampling sites.

**Keywords:** Diversity, endemism, *Neolissochilus sumatranus*

### INTRODUCTION

Freshwater ecosystem may be the most endangered ecosystems in the world. Fish diversity represents as much as one third of all vertebrate species, and declines in freshwater fish is occurring at a greater rate than species loss in the most affected terrestrial ecosystems (Sala et al. 2000; Dudgeon et al. 2006). Our knowledge of freshwater diversity is woefully incomplete; especially in tropical latitudes that supports the greatest proportion of species diversity (Stiassny 2002). In the Indo-Pacific region, Indonesia has the highest freshwater fish species richness (Allen 1991; Kottelat and Whitten 1993) and is a mega-biodiversity country along with Brazil. Indonesian is home to approximately 1000 species of freshwater fishes (Suwelo 2004) relative to 50,000 fish species worldwide (Vida and Kotai 2006). Of these about 22,000-25,000 species have been named with valid description (Allen 2000; Gilbert and Williams 2002) and new species are being discovered or recognized at a rate of approximately 200 species per year of which 40% are freshwater fishes (Nelson 1994).

According to Zakaria-Ismail (1994), the distribution pattern of Southeast Asian freshwater fishes can be divided into five zoogeographic regions. The island of Sumatra, Borneo and Java are the fourth zoogeographic area on the fish distribution and characterized by a high degree of endemism. Sumatra has a number of major rivers, with the Batang Toru River being one of them. It is located in Batang Toru forest. According to Khakim (2011), Batang Toru forest covers some 136.000 ha of primary forest. The forest is located in North Sumatra. It is situated in three sub-districts, North Tapanuli, Central Tapanuli and South

Tapanuli. The greater part of the Batang Toru forest is at present allocated as production forest and land to be converted to other uses (81%) and only a small part (19%) is allocated as protected forest.

Batang Toru River systems and its tributaries are critical habitat for abundant freshwater fish resources ranging from socially and economically important species such as Gariang (Mahseer fish), *Puntius* (barb) and Rasbora (minnow). There is lack of knowledge regarding to species diversity in the Batang Toru while there was an anthropogenic activities, over fishing till human building such as dam are known as critical factor for fish diversity in entire river's length and its tributaries. It is therefore critical to assess species diversity along the stretch of the Batang Toru River in terms of endangered, rare, and endemic species and related threats from anthropogenic activities in order to guide planning of conservation interventions.

Studies of fish diversity are needed to establish an inventory of the fish fauna present in the Batang Toru river systems area. This study aims to develop baseline data that will be valuable to assess the future environmental impacts of development and conservation.

### MATERIALS AND METHODS

#### Study site

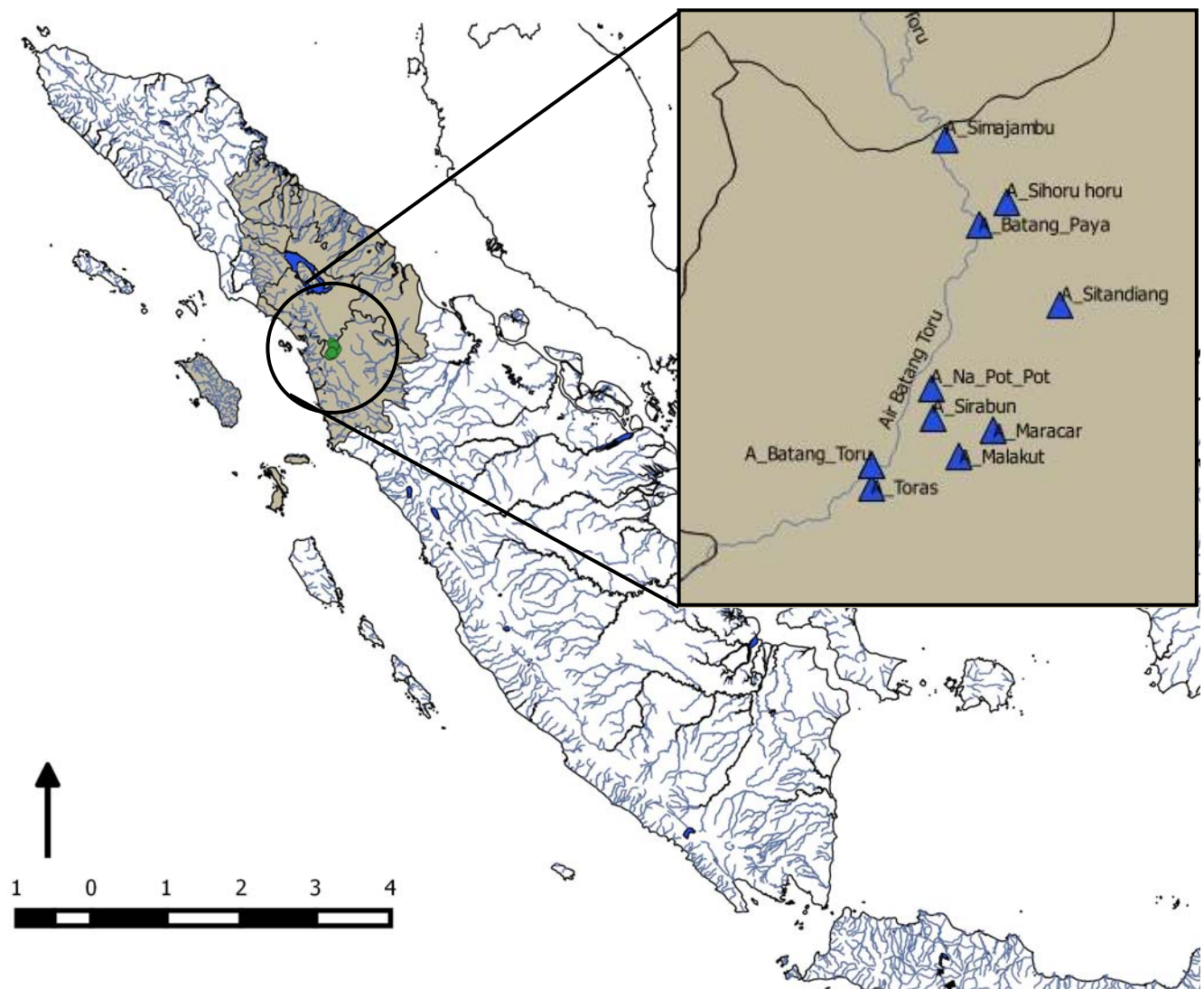
We sampled fish in eleven locations in Batang Toru River systems comprises of Aek Malakut, Aek Toras, Aek Sikkut, Aek Batang Toru, Aek Marancar, Aek Sitandiang,

Aek Simajambu, Aek Sihoru-horu, Aek Batang Paya, Aek Na Pot Pot, and Aek Sirabun (Figure 1). Sampling was done in the sub-districts of Batang Toru, Marancar, Sipirok in South Tapanuli District, North Sumatra, Indonesia. We sampled the sites in daylight hours between 8-14 February 2015 and between 15-21 March 2015. The eleven sampling locations comprised each of two sites (upstream and downstream reference). Downstream locations refer to locations towards the main Batang Toru River.

#### Sampling methods

Sampling was done by following standard procedures according to Cailliet et al. (1986), using cast fishing nets (1st sampling session, 8-14 February 2015) and backpack electrofishing gear (12 Volt) during the 2nd sampling

session (15-21 March 2015). Sampling at each location was done for approximately one hour. For each fish sample obtained, we described key characteristics such as body color, color of fins which may get lost or change after death, made measurements of the shape of the body, photographed each sample, and preserved samples with formalin 10%, after which they were taken to the laboratory at Universitas Andalas in Padang, West Sumatra. Not all individual fish caught were taken as a sample. For those species whose sample number was considered sufficient, specimens were released back into the river. All specimens were later preserved in 70% ethanol. Identifications were based on the main keys for freshwater fishes in the region (Weber and Beaufort 1916; Kottelat et al. 1993; Kottelat 2013).



**Figure 1.** Sampling location in Batang Toru River System, North Sumatra

## RESULT AND DISCUSSION

A total of 427 individuals fish samples were collected, consisting of 24 species placed in 10 families (Table 1). Samples were collected at 12 locations on 11 rivers. The species encountered were from the following families: Cyprinidae (11 species), Balitoridae (2), Channidae (2), Gobiidae (2), Nemacheilidae (2), Aplocheilidae (1), Bagridae (1), Cichlidae (1), Mastacembelidae (1) and Sisoridae (1). A juvenile of *Tilapia niloticus*, recorded in Aek Simajambu which predicted as an alien species because the downstream of the sampling sites has been used as an area of "Lubuk Larangan" and according to local people interview, the used they Lubuk Larangan as cages of Tilapia species. Lubuk Larangan is a segment of the river where the public is prohibited to catch fish in the timeframe set together.

We recorded the largest family in Batang Toru is Cyprinidae which consists of eleven species. Those species are *H. macrolepidota*, *M. marginatus*, *N. sumatranus*, *O. hasseltii*, *O. waandersii*, *P. binotatus*, *R. elegans*, *T. douronensis*, *T. soro*, *T. tambra* and *T. tambroides* (Table 1). Cyprinidae is the largest Family of freshwater fish and are spread all over the world except Australia, Madagascar, New Zealand and South America (Kottelat et al. 1993; Nelson 1994). Cyprinids are good source of proteins and as ornamental fish therefore they are economically important (Sharma et al. 2014). *Hampala macrolepidota*, *Neolissochilus sumatranus*, *Osteochilus hasseltii*, *O. waandersii*, *Tor tambra*, *T. douronensis*, *T. soro*, and *T. tambroides*, are economically important fish, with *Tor spp.* are sold at high local prices. Those fish species are also used in traditional ceremonies in Batak tribe at North Sumatra. *Tor spp.* are also potential species for freshwater sport fishing, like Salmon, because they are strong swimmers. Unfortunately, population of *Tor* in native habitats is becoming rare while their domestication has not been successful, and its systematic still problematic (Ng 2004).

Almost all of Sumatran *Tor* species has been recorded in Batang Toru. Currently, overfishing and habitat perturbation bringing them into declining population in the wild. Taxonomic chaotic also leave a big question for ichthyologist to make decision about their conservation status. *Tor spp.* are interesting both for consumption as well as to be kept as ornamental fish, commonly are known as Mahseer fish. This fish has low population density primarily due to degradation of freshwater habitat, both in quality and quantity. This fish species is very sensitive to the water changes. In addition, uncontrolled harvesting and distortion of the riverine ecosystem and its surrounding habitats have further contributed to the general decline in number of *Tambra* fish in the world.

*Neolissochilus* has three species, which two of them noted as endemic Sumatra island, one in Toba Lake, North Sumatra (Kottelat et al. 1993). Most of *Tor* and *Neolissochilus* are threatened especially by forest clearing and overfishing. *N. sumatranus* as an endemic island species named by Weber and Beaufort (1916) as *Lissochilus sumatranus* n. sp. Generally, local villager named both of *N. sumatranus* and *Tor* as "Jurung" because

of their morphological similarity.

*Puntius binotatus* is commonly found in rivers which are also potentially as ornamental fish. Based on molecular (Roesma 2011) and morphological studies (Vitri et al. 2012) the *P. binotatus* from several locations in West Sumatra showed an overview of the complexity, genetic variation and differences in morphological characters between sampling locations. We need to pay attention on this species, The status of *Puntius* is obscure, the delimitation and nomenclatural validity of the genus have remained unsettled, largely owing to the scantiness in knowledge of its inter and intrageneric relationships (Taki et al. 1978). The synonymous name of *Puntius* is *Barbodes* (Kottelat 2013).

Species with high presence were *Glyptothorax platypogonoides* and *Nemacheilus pfeifferae* (54.55%). These two species live in clear and fast-flowing water. According to Kottelat et al. (1993) and Kottelat (2012) *N. pfeifferae* distributed in Sumatra. Previous study suggested that *N. pfeifferae* in West Sumatra has low variation in morphological characters. Species with low variation in genetic and morphological characters are very vulnerable to extinction. *N. pfeifferae* is considered as an ecological indicator species.

Figure 3. shows the value of Shannon-Wiener ( $H'$ ) species diversity index of all locations sampled in the Batang Toru Rivers Ecosystem. This index gives an illustration on the species diversity, the productivity of ecosystems, the pressures on ecosystems, and the stability of ecosystem. Fish communities respond significantly and predictably to almost all kinds of anthropogenic disturbances, including eutrophication, acidification, chemical pollution, flow regulation, physical habitat alteration and fragmentation, human exploitation and introduced species (Li et al. 2010). A value of  $H' < 1.0$  means low diversity, low productivity as an indication of severe ecological pressures, and unstable ecosystem. A value of  $1.0 < H' < 3.322$  means moderate diversity, sufficient productivity, with ecosystem conditions being fairly balanced, and medium ecological pressure. Values of  $H' > 3.322$  mean high species diversity, high productivity and stable ecosystem. From the 11 samples sites none of these indicated high diversity. From personal communication with local people living near the sampling areas, we know that years ago some people used a poison to catch fish resulting in mass mortality of fishes in that area. However, we still sampled rivers with moderate  $H'$  index value. The highest one is Aek Simajambu ( $H' = 2.06$ ). We sampled at upper part of a "Lubuk Larangan" on this river.

The next river with a high diversity is Aek Batang Paya ( $H' = 1.85$ ). The location is very interesting because of all kinds of "Jurung" fish which consisting of *N. sumatranus*, *T. douronensis*, *T. soro*, *T. tambra* and *T. tambroides* can be found in that river. We also recorded the the highest frequency of presence species in this river is *T. douronensis* (42%) from the total number of species collected, followed by *T. soro* (15%), *T. tambra* (3:33%) and *T. tambroides* (1.67%). Furthermore, we found that *N. sumatranus* had absence percentage value 8.33% among other species in this locality. This value also observed in Aek Malakut ( $H' = 0.59$ ) and Aek Na Pot Pot ( $H' = 1:16$ ) for *N.*

*sumatranus*, , therefore we recommend that three of those river as preferred habitat of its species as known by the high number of individuals *N. sumatranus* (30 individuals for each river). In despite of this, we also supposed that Batang Paya (H' = 1.85) and Aek Sirabun (H' = 1.39) are the preferred habitat by *T. douronensis*, as known by the high number of individuals *T. douronensis* ( 25 and 33 individuals for each river). However, we found that another three species of *Tor* species had less appearance for the rest localities.

There are several factors which contributed to affect the diversity which interacting each other. They are over-exploitation, water pollution, flow modification, destruction or degradation habitat and invasion by exotic

species (Allan and Flecker 1993; Jackson et al. 2001; Postel and Richter 2003; Revenga et al. 2005). Environmental changes also contributed which occurring at global scale, for example nitrogen deposition, warming and shifts in precipitation and runoff patterns (Galloway et al. 2004; Dudgeon et al. 2006). The freshwater environment conservation and management are critical to the interest of all nations and governments (Hadwen et al. 2003; Dudgeon et al. 2006). The problem for most part of the ichthyologist is inventories of freshwater biodiversity are incomplete in many part of the world. Conservation of biodiversity is complicated posed by endemism, limited geographic ranges and non-substitutability (Dudgeon et al. 2006).

**Table 1.** Fish species collected in Batang Toru River System, North Sumatra

Species	Common name	Conservation status (IUCN 2014)	Locality
<b>Aplocheilidae</b>			
<i>Aplocheilus panchax</i> (Hamilton, 1822)	Blue panchax	LC	TRS
<b>Bagridae</b>			
<i>Mystus planiceps</i> ( Valenciennes, 1840)	-	NA	BTR, SMJ
<b>Balitoridae</b>			
<i>Homaloptera gymnogaster</i> ( Bleeker, 1853)	Balitora sumatranska	NA	MLK, TRS, NPP
<i>Homaloptera heterolepis</i> (Weber & de Beaufort, 1916)	Ray finned fish	NA	NPP
<b>Channidae</b>			
<i>Channa lucius</i> (Cuvier, 1831)	Forest snakehead	LC	SMJ
<i>Channa melasoma</i> (Bleeker, 1851)	Black snakehead	LC	TRS, NPP
<b>Cichlidae</b>			
<i>Tilapia niloticus</i> Linnaeus, 1758	Nile tilapia	NA	SMJ
<b>Cyprinidae</b>			
<i>Hampala macrolepidota</i> (Kuhlt & van Hasselt, 1823)	Hampala barb	NA	BTR, SMJ
<i>Mystacoleucus marginatus</i> (Valenciennes, 1832)	Wader	LC	BTR, BTP
<i>Neolissochilus sumatranus</i> (Weber & de Beaufort, 1916)*	Parmoun sumatransky	NA	MLK, SKT, MRC, STD, SHR, BTP, NPP, SRB
<i>Osteochilus hasseltii</i> (Valenciennes, 1842)	Silver sharkminnow	LC	SKT, BTR, SMJ, BTP
<i>Osteochilus waandersii</i> (Bleeker, 1853)	Waandersii's hard-lipped bard	LC	SKT, BTR, SMJ, BTP
<i>Puntius binotatus</i> (Valenciennes, 1842)	Common barb	LC	TRS, SKT, MRC, STD, SMJ, BTP, NPP, SRB
<i>Rasbora elegans</i> (Volz, 1903)	Twospot rasbora	LC	SMJ
<i>Tor douronensis</i> (Valenciennes, 1842)*	Mahseer	DD	SKT,STD,SHR,SMJ,BTP, NPP, SRB
<i>Tor soro</i> (Valenciennes, 1842)*	Mahseer	DD	MLK, SHR, SMJ, BTP, NPP
<i>Tor tambra</i> (Valenciennes, 1842)*	Mahseer	DD	BTP, SRB
<i>Tor tambroides</i> (Bleeker, 1854)*	Mahseer	DD	BTP
<b>Gobiidae</b>			
<i>Glossogobius</i> sp.1	Gobies	-	BTR
<i>Glossogobius</i> sp.2	Gobies	-	BTR
<b>Mastacembelidae</b>			
<i>Macrognathus maculata</i> (Cuvier, 1832)	Spiny eel	LC	SMJ
<b>Nemacheilidae</b>			
<i>Nemacheilus chrysolaimos</i> (Valenciennes, 1846)	-	NA	TRS
<i>Nemacheilus pfeifferae</i> (Bleeker, 1853)	-	NA	TRS, BTR, STD, SMJ, BTP, SRB
<b>Sisoridae</b>			
<i>Glyptothorax platypogonoides</i> (Bleeker, 1855)	-	NA	BTR, STD, SMJ, BTP, NPP, SRB

Note: MLK= Aek Malakkut; TRS= Aek Toras; SKT= Aek Sikkut; BTR= Aek Batang Toru; MRC= Aek Marancar; STD= Aek Sitandiang; SHR= Aek Sihoru-horu; SMJ= Aek Simajambu; BTP= Aek Batang Paya; NPP= Aek Na Pot-Pot; SRB= Aek Sirabun. LC= Least Concern, DD= Data Deficient, NA= Not Assessed in IUCN Red List, Ni=Could not compare to IUCN; \*upstream for spawning migrators species

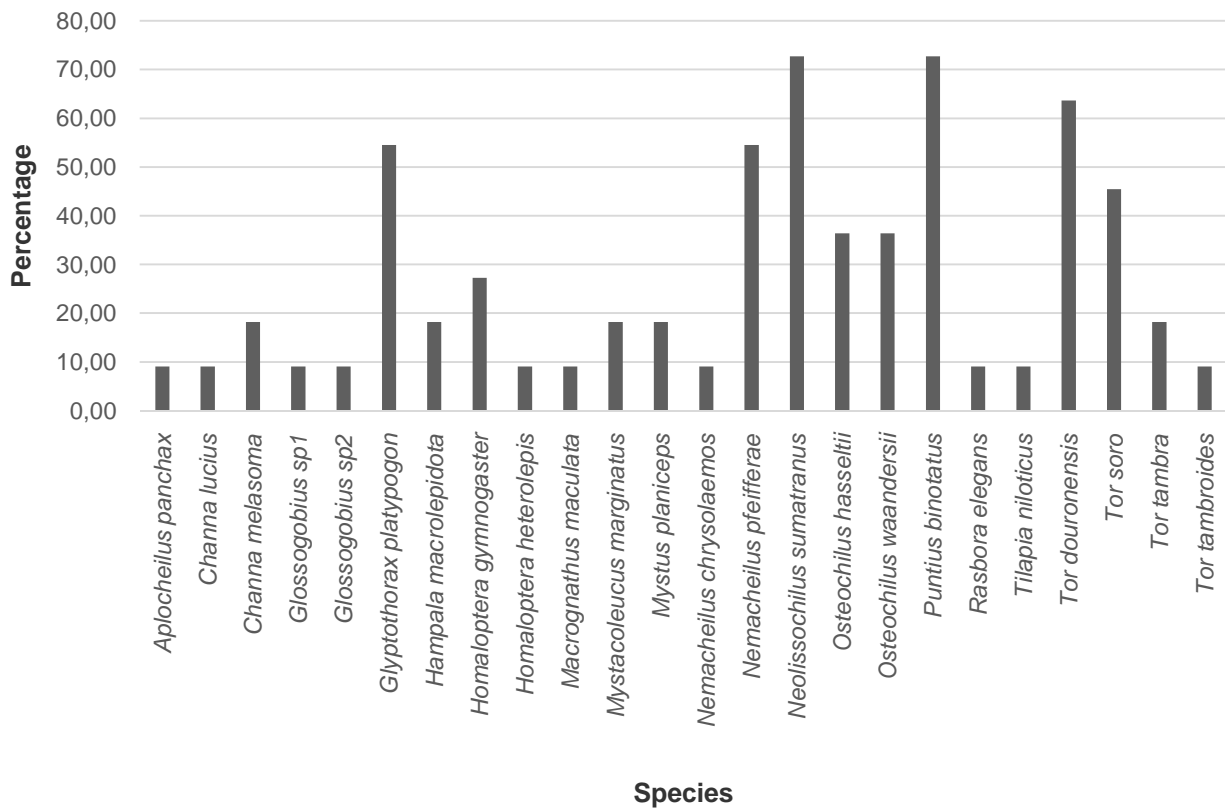


Figure 2. Percentage of fish species detected in Batang Toru River System, North Sumatra

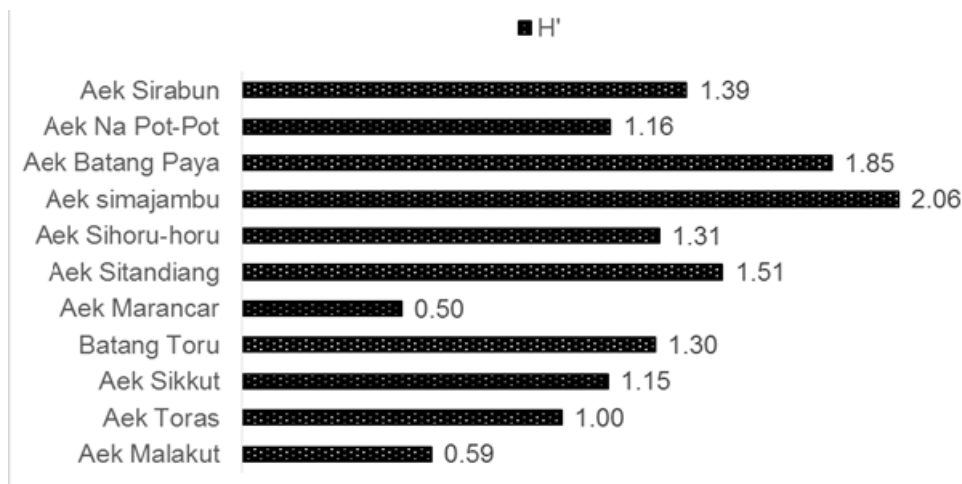
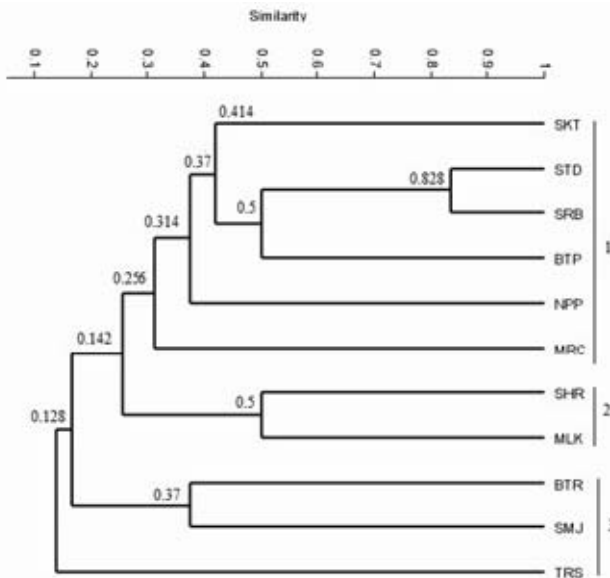


Figure 3. Shannon-Wiener species diversity in the Batang Toru River, North Sumatra

It is recommended to pay attention to the water condition in those rivers because it is important for Jurung fish habitat. As this fish species is a migratory species, heading to the headwaters for spawning, they need clear water and fast flowing rivers. We also found higher densities of *N. pfeifferae* in Aek Simajambu and Aek Sirabun than in other rivers. Both of them have a clear river water, rocks, sand gravel substrate, 0.85 to 0.88 flow

velocity m/s and largely shielded by vegetation. We consider this species as an ecological indicator species. An ecological study need to be done to support our prediction.

We also looking at similarity of species richness among the tributaries (Figure 4). Those tree were constructed according to presence and absence species between the river system. Among 11 tributaries, we recorded that Aek Sitandiang and Aek Sirabun shared the same species



**Figure 4.** Similarity index of presence and absence species among tributaries

closely. Both of rivers showed the same species such as *N. sumatranus*, *P. binotatus*, *T. douronensis*, *N. pfeifferae*, *G. platypogon* with similarity index 0.828. There are three groups according to the similarity of species present among eleven rivers. Those are Aek Sikkut, Sitandieng, Sirabun, Batang Paya, Na Pot Pot and Marancar as group 1, Aek Sihoru horu and Malakut as group 2, and Batang Toru, Simajambu and Toras as another group. The rivers in group 1 commonly has the same species recorded such as *N. sumatranus*, *P. binotatus*, *T. douronensis*, *N. pfeifferae*, and *G. platypogon*. Whereas the second group only have two similar species detected (*N. sumatranus* and *T. soro*). Batang Toru and Aek Simajambu have 6 similar species recorded (*M. planiceps*, *H. macrolepidota*, *O. hasseltii*, *O. waandersii*, *N. pfeifferae*, *G. platypogon*) but in comparison to group 1, they only have two common species. The similarity value between group and river provided in Figure 4.

Batang Toru River system has a complex water flows systems with variety environmental variables along the tributaries. There was lack evidence of relationship between different environmental affect the species richness in this study. Further research and survey are needed in order to know the factor which might be causing the differences of species assemblages in each locality.

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