Aquatic Insect (Larvae) Distribution and Assemblages at River Intakes in Pergau Lakes

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Abstract. Aquatic insect larvae is one of the biotic component in aquatic ecosystem that helps in balancing aquatic ecosystems.Therefore, a survey conducted to determine the distribution and assembalges on aquatic insect larvae in Pergau Lake River Intakes. Samples were collected using Surber Net at seven river intakes in Pergau lakes namely Sungai Long (Intakes 1 and 2), Sungai Renyuk (Intakes 1, 2 and 3), Sungai Terang, and Sungai Suda. A total of 733 individuals were collected comprising seven orders (Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Diptera, Odonata and Lepidoptera) with 43 families and 70 genus. Sungai Renyuk recorded highest abundance of aquatic insects followed by Sungai Long with 602 individuals and 110 individuals respectively. The lowest abundance of aquatic insect was at Sungai Suda which only two insecta orders found namely Diptera(Chironomidae) and Coleoptera (Elmidae). Ephemeroptera (22%), Chironomidae (38%) and Elmidae (22%) were the common family found at all station excepts Sungai Suda intakes that only found Chironomidae and Elmidae. The resutls shows how aquatic insects larvae assamblage and distribute differently at seven intakes.

1. Introduction

Aquatic insect larvae is one of the benthic macroinvertebrates used as bioindicator for river health ecosystmes [1,2]. Each order of aquatic insect larvae has its own tolarance towards river charateristics changes [3]. The changes of river characteristics can create new microhabitats or reduce the existing microhabitats [4]. The reduction of this microhabitat can lead to the domination of certain benthic macroinvertebrates that favour conditions of microhabitat [5,6].

Microhabitat usually provide the best conditions such as food availability and predator protection for certain aquatic insects to survive according to their morphology and feeding behaviour [5]. For examples net spinning Trichoptera (Hydropsychidae) need high composition of boulder, cobble and gravels with fast water flow to trap food and shelter from their predators. Ephemeroptera family named Hetpageniidae has flattened head morphology so they can remain at the surface of rocks and

feeding the algaes even at fast flowing water. The gills of severals aquatic insects larvae sensitive to the high total suspended solid in water asa they are not covered and suits with fast flowing water to trap the oxygen dissolve in water [7].

Pergau Lake River Intakes located at dam constructions at four rivers such as Sungai Long, Sungai Renyuk, Sungai Terang and Sungai Suda. The construction of dam change the existance rivers and create new microhabitats. However, the river intakes has fast flowing water with severals microhabitats that suits the aquatic insects larvae such as Ephemeroptera, Plecoptera, Trichoptera, Diptera, Aquatic Lepidoptera, Odonata and Coleoptera. Therefore, this study aims to determine the distribution and assemblages of these orders in this four rivers with seven intakes.

2. Methodology

2.1 Study Area

There are seven river intakes located in Pergau Lake area. Figure 1 shows tha map of those seven intakes. All sample was collected at small dam intakes for upper and downstreams except for Sungai Terang Downstream and Sungai Long Downstream as it is difficult to access and not suitables for Surber Net sampling methods.

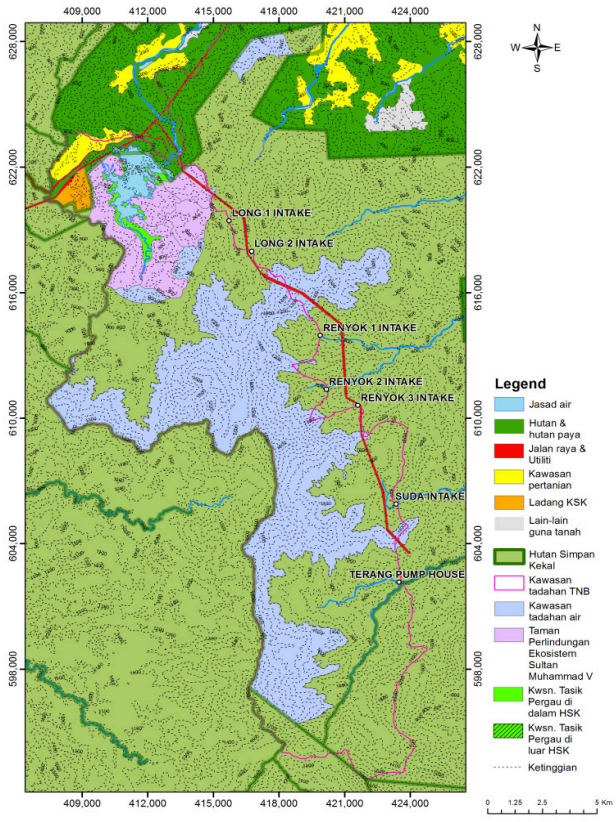

Figure 1. Seven River Intakes Map

2.2 Sampling Method

Aquatic insects larvae were randomly collected using Surber net with a size of 0.3 m x 0.3 m at several microhabitat at river intakes. The samples transferred into a plastic zipper bag with 75% of ethanol as preseravtion and brought back to the laboratory for identification process.

2.3 Aquatic Insect Larvae Identification

The samples of aquatic insects larvae were sorted and identified based on their morphology [8]. Samples were placed in the universal bottle with 75% ethonal.

3. Results

A total of 733 individuals of aquatic insects larvae collected from seven river intakes in Pergau Lake. Eighty percent (80%) of aquatic insects larvae distributed at Sungai Renyuk. It is about twenty-two (22) genus aquatic insect larvae were found at this intakes from seven orders (Figure 2). Table 1 shows the abundance of aquatic insect larvae collected from all study area. The most abundance families found were Chironomidae (Subfamily: Orthocladiinae, Chironomini, Tanytarsini, Tanypodinae) and Tipulidae (*Antocha* sp.) followed by Elmidae (*Narpus* sp.) and Baetidae (*Baetis* sp., *Nigrobaetis* sp., *Playtibaetis* sp. and *Gratia* sp.).

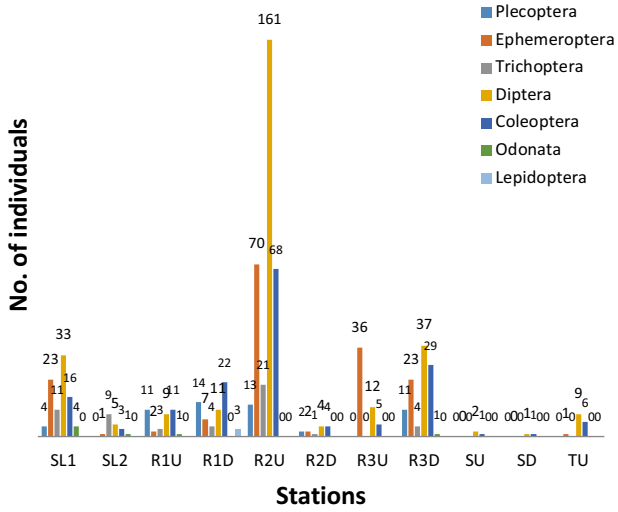

Figure 2. distribution of aquatic insects larvae orders at all station

Even though dipteran was the most abundance larvae found, yet the most diverse families found are Trichopteran followed by dipteran, ephemeropteran and Coleoptera. 12 families can be found at Pergau Lake Intakes such as Ecnomidae, Lepidostomatidae, Polycentropididae, Polycentropididae, Stenopsychidae, Hydropsychidae, Leptoceridae, Hydropitilidae, Rhyacophilidae, Philopotamidae, Psychomyiidae and Dipseudopsidae. The most abudance of Trichopteran found is Hydropsychidae (*Cheumatopsyche* sp., *Ceratopsyche* sp. and *Diplectrone* sp.) followed by Polycentropodidae and Philopotamidae. However, no Trichopteran found at Sungai Suda and Sungai Terang. The most diverse Trichopteran foun at Intakes 2 for Sungai Long (*Stenopsyche* sp., *Ceratopsyche* sp., *Hydrosyche* sp., *Diplectrone* sp., *Cheumatopsyche* sp., *Ceraclea* sp. and *Hydroptila* sp.) and Sungai Renyuk (*Stenopsyche* sp., *Ceratopsyche* sp., *Cheumatopsyche* sp., *Chimmara* sp., *Dolophilodes* sp., and *Tinodes* sp.).

In overall, there are seven ephemeropteran families (Teloganodidae, Leptophlebiidae, Caenidae, Heptageniidae, Ephemerellidae, Baetidae, Ephemeridae) found in Sungai Pergau that composed of twelves (12) genus such as *Teloganodes* sp., *Teloganella* sp., *Isca* sp, *Choroterpides* sp., *Caenis* sp., *Asionurus* sp., *Crinitella* sp., *Baetis* sp., *Nigrobaetis* sp., *Playtibaetis* sp., *Gratia* sp. and *Ephemera* sp.. All of genus were found only at Sungai Long, Sungai Renyuk, Sungai Terang. There is no sign of existence of ephemeroptera at Sungai Suda and not all genus found at all intakes. The most abundance ephemeropteran found at Sungai Renyuk were Baetidae and Leptophlebiidae. In contrast, more

Teloganodidae, Caenidaea, and Heptaganidae were found at Sungai Long and only Baetidae found at Sungai Terang.

Apart from Dipteran (Chironommidae), Coleopteran is another order which can be found at all intakes espeacially Elmidae (*Narpus* sp.). The compositions of elmidae is increased at intakes with high abundance of aquatic insects larvae. The other coleopteran found were Psephenidae (*Psephenus* sp.*, Dicranopselaphus* sp.), Scirtidae (*Elodes* sp. and *Scirtes* sp.), Gyrinidae (*Gryinus* sp.), Hydrophilidae (*Laccobius* sp.*, Berosus* sp. and *Helophorus* sp.) and Eulichadidae (*Stenocilus* sp.). *Elodes* sp. was only distributed at Sungai Renyuk for all intakes while Hydrophilidae was only found at intakes 2 (*Laccobius* sp.*, Berosus* sp. and *Helophorus* sp.) and 3 (*Helophorus* sp.). However, *Psephenus* sp. and *Dicranopselaphus* sp. were only found at Sungai Long. Similar to *Stenocilus* sp. which only found at Sungai Renyuk intakes 1.

Perlidae which is one of the most sensitive to pollution taxa was only found at Sungai Long and Renyuk. However, as compared to Sungai Long, Sungai Renyuk composed a diverse Plecoptera genus which were *Neoperla* sp.*, Kamimuria* sp.*, Indonemoura* sp. and *Sphaeronemoura* sp.

In contrast, Sungai Long composed a diverse odonata (tolarance taxa) compared to Sungai Renyuk. Euphaidae (*Euphaea* sp.), Coenagrionidae (*Argia* sp.), Ghompidae (*Ghompus* sp.) and Platysticidae (*Palaemnema* sp.) were four families found at Sungai Long. In contrast, the only odonata found at Sungai Renyuk is Ghompidae (*Erpetoghompus* sp.) that was found in intakes 1.

4. Discussion

The distribution of aquatic insects larvae at all intakes were varies and this shows the difference in microhabitat formation at different intakes at Pergau Lakes. All of intakes have canal intakes structure that interrupted the ecosystem of the rivers and create new microhabitats. However, the distribution of aquatic insect larvae among intakes at same source of river was not much differs except for Sungai Terang and Sungai Suda. Less aquatic insects larvae were found at Sungai Terang and Sungai Suda. Sungai Terang and Sungai Suda had the highest composition of silt substrates compared to Sungai Renyuk and less debris substrates compared to Sungai Long. Therefore, less aquatic insects larvae found as those substrates is one of the microhabitats for most sensitive benthic macroinvertebrates as protection and food source [6]. Sungai Terang was less covered canopy compared to others intakes. This might affect the assemblages of aquatic insect larvae when the food sources are scare as lack of leaf litters from canopy that can create another microhabitats [9]. However, Sungai Terang composed more cobble, boulder and bedrock compared to Sungai Suda. Therefore, some Ephemeropteran, Plecopterans and Trichopteran (EPT) can be found abundantly here compared to Sungai Suda. Riffles area has created by compositions of cobble and boulder at fast flowing and shallow rivers, that makes favorable habitats for EPT [10]. In contrast, Sungai Long 2 also composed more silt compared to boulder yet still composed higher EPT. However, Sungai Long 2 composed of more Trichoptera compared to Plecoptera and Ephemeroptera. More diverse Trichoptera at Sungai Long 2 is due to the higher emerged tree roots and leaf litters compared to Sungai Suda. Most Trichoptera genus found also use those substrates to build their casing and trap their food.

All seven Pergau Intakes areas used to be renovated river for dam and road construction. However, Sungai Renyuk composed abundant of aquatic insect larvae compare other intakes is expected due to the diverse microhabitat. Compared to other intakes, Sungai Renyuk composed three biotopes such as riffles, pools and run. According to Harrison *et al*. [11] the artificial riffles and flow deflector installation in lowland rivers can recreate functional habitats that can increase the relative abundance of benthic rheophilic taxa such as Beatidae, Ephemerellidae, Elmidae, Hydropsychidae and Simuliidae. Table 1 shows Renyuk intakes composed abundant of this family especially Sungai Renyuk 2. This shows the renovation of dam and road occur at these intakes indirectly and naturally forming the artificial biotopes that helps the river recover over the time.

This study also showed high abundance of Chironomidae at all intakes. Even this family of diptera is has high tolerance to pollution, yet it used to be found abundantly in good water quality habitat. According to Ahmad *et al*. [12], several genus of Orthocladiinae and Chironomini has a potential to

be a bio-indicator for good water quality. This is supported by Odume & Muller [13] several genus or species of Chironomidae can be use to assess environmental water quality status.

5. Conclusion

In conclusion, Sungai Suda and Sungai Terang intakes show the less composition of aquatic insect larvae compared to Sungai Renyuk dan Sungai Long intakes. This study found that the less microhabitat at Sungai Suda intakes and Sungai Terang Intakes cause the less composition of aquatic insect larvae collected.

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Table 1. Aquatic insect larvae abundance (No. of individual) at all study area.

Station		**SL1**	**SL2**	**R1U**	**R1D**	**R2U**	**R2D**	**R3U**	**R3D**	**SU**	**SD**	**TU**	**TOTAL**
Plecoptera													
Perlidae	*Neoprela* sp.	4		4	13	6			5				32
	Etrocorema sp.					4			3				7
	Kamimuria sp.			7	1	2	2						12
Nemouridae	*Indonemoura* sp.								3				3
	Sphaeronemoura sp.					1							1
Ephemeroptera													
Teloganodidae	*Teloganodes* sp.	3		1				2	3				9
	Teloganella sp.	4				1							5
Leptophlebiidae	*Isca* sp.	4				8			4				16
	Choroterpides sp.		1										1
Caenidae	*Caenis* sp.	5						1					6
Heptageniidae	*Asionurus* sp.	2				1							3
Ephemerellidae	*Crinitella* sp.			1		1							2
Baetidae					7								7
	Baetis sp.	4				13		33	5				55
	Nigrobaetis sp.	1				11			5			1	18
	Playtibaetis sp.					22	2		6				30
	Gratia sp.					12							12
Ephemeridae	*Ephemera* sp.					1							1
Trichoptera													
Ecnomidae	*Ecnomus* sp.	1											1
Lepidostomatidae	*Lepidostoma* sp.	1											1
Polycentropididae	*Nyctiphylax* sp.	8											8
	Cyrnellus sp.				1								1
Stenopsychidae	*Stenopsyche* sp.		1			3							4
Hydropsychidae	*Ceratopsyche* sp.		2			4			1				7
	Hydrosyche sp.		2				1		1				4
	Diplectrone sp.				2								2
	Cheumatopsyche sp.	1				10							11
Leptoceridae			2										2
	Ceraclea sp.		1										1
Hydropitilidae	*Hydroptila* sp.		1										1

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Station		**SL1**	**SL2**	**R1U**	**R1D**	**R2U**	**R2D**	**R3U**	**R3D**	**SU**	**SD**	**TU**	**TOTAL**
	Stactobiella sp.								1				1
Rhyacophilidae	*Rhyacophila* sp.								1				1
Philopotamidae	*Chimmara* sp.			2		1							3
	Dolophilodes sp.					2							2
Psychomyiidae	*Psychomyia* sp.			1									1
	Tinodes sp.					1							1
Dipseudopsidae	*Pseudoneureclipsis* sp.				1								1
Diptera													
Chironomidae	Orthocladiinae	4		3	5	20	3	4	8			2	49
	Chironomini	15				21	1	2			1	2	42
	Tanytarsini	4	1		1	15		1	3	1		1	27
	Tanypodinae	2	2			18		5	7			1	35
Tipulidae						7						1	8
	Antocha sp.	7	1	5	2	59			13	1			88
	Hexatoma sp.					5			3				8
	Limnophilla sp.				1								1
Ceratopogonidae	*Bezzia* sp.	1	1										2
Tabanidae	*Tabanus* sp.											1	1
	Luecotabanus sp.					1							1
Dolichopodidae	*Rhapium* sp.											1	1
Simuliidae	*Simulium* sp.					12			2				14
Dixidae	*Dixa* sp.				2				1				3
Psychodidae	*Neotelmatoscopus* sp.			1									1
Empididae	*Hemerodromia* sp.					1							1
Athericidae	*Atherix* sp.					2							2
Coleoptera													
Elmidae	*Narpus* sp.	10		10	18	56	2	5	21	1	1	3	127
Psephenidae	*Dicranopselaphus* sp.	2											2
	Psephenus sp.	2	3						1				6
Scirtidae	*Scirtes* sp.	1											1
	Elodes sp.			1	1	4	2		6				14
Gyrinidae	*Gryinus* sp.	1											1
Hydrophilidae	*Laccobius* sp.					6						3	9
	Helophorus sp.								1				1
	Berosus sp.					2							2
Eulichadidae	*Stenocilus* sp.				3								3

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Station		**SL1**	**SL2**	**R1U**	**R1D**	**R2U**	**R2D**	**R3U**	**R3D**	**SU**	**SD**	**TU**	**TOTAL**
Odonata													
Euphaidae	*Euphaea* sp.	3											3
Coenagrionidae	*Argia* sp.	1											1
Ghompidae	*Ghompus* sp.		1										1
	Erpetoghompus sp.								1				1
Platysticidae	*Palaemnema* sp.			1									1
Lepidoptera													
Cramhidae	*Eoophyla* sp.				3								3
Abundance (No of individuals)		91	19	37	61	333	13	53	105	3	2	16	733

Notes:
SL1= Sungai Long 1, SL2=Sungai Long 2, RD=Renyuk downstream, RU= Renyuk Upstream, SU=Suda Upstream SD= Suda Downstream and TD= Terang Downstream