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Identification and Description of Aquatic Oligochaeta in Sanggau City Canal West Kalimantan

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Abstract

The canal, which is located in the center of Sanggau City, West Kalimantan, is a channel for water to flow directly into the Kapuas River. The dense activity of the surrounding community has caused indications of contamination of this canal by organic and inorganic materials. Pollutants enter continuously and accumulate, thereby changing the structure of the substrate which becomes a habitat for benthic fauna such as aquatic Oligochaeta. This study aims to identify and describe the types of aquatic Oligochaeta found in the canals of Sanggau City. This research was conducted in August-September 2020 using a purposive sampling technique. Sampling locations were carried out at five stations consisting of Tanjung Sekayam Village, Ilir Kota Village, Beringin Village and Bunut Village. The Sanggau City Canal has a depth ranging from 0. 24 m – 1 m with water brightness 0.14 m – 0.24 m. The canal which is a lotic water also has a current velocity range of 0.04 m/s – 0.40 m/s with a temperature of 27°C – 29°C and pH 6.0 – 6.7. Dissolved oxygen in the canals of Sanggau City which plays an important role in the survival of aquatic Oligochaeta is obtained 3.0 mg/l – 5.8 mg/l, and C-Organic 0.05% - 3.82%. The substrate in the canal of Sanggau City is composed of 23.31% - 95.31% sand, 4.69% - 57.49% silt and 0.00% - 19.20% clay.Each sampling station consists of three repetition points. Based on the results of research conducted on five canals in Sanggau City, aquatic Oligochaeta were found consisting of 1 order, 1 family, 2 genera and 3 species with a total of 1367 individual aquatic Oligochaeta. The identified aquatic Oligochaeta species consisted of B. sowerbyi, L. claparedeianus, and L. hoffmeisteri.

Keywords: Species Identification, Aquatic Oligochaeta, Sanggau City Canal.

INTRODUCTION

Sanggau City is the capital of Sanggau Regency which is located in Kapuas District, West Kalimantan. Based on its geographical location, Sanggau City is located at 00°08' North Latitude and 110°43' East Longitude. The canal in the center of Sanggau City is currently a medium for flowin water, such as surface water (run off) to the waters of the Kapuas River. Physical characters such as the smell and color of the water in the canals indicate that the waters have been polluted by organic matter. This condition is the cause of the presence of waste materials both organic and inorganic as well as the results of degradation by microbes that live in the water (Diaz, 2008).

Canals are a group of lotic ecosystems which are a habitat for aquatic macroinvertebrates in them. The biotic and abiotic components of the waters will form a functional relationship that influences each other, so that it will form an energy flow that supports the stability of the ecosystem (Suwonndo & Alpusari, 2004). The condition of the canal waters in Sanggau City also directly influences the benthic organisms in it, such as the Oligochaeta group. Oligochaeta are a group of worms belonging to the Clitellata class (Phylum Annelida) with bodies that have annular rings (Edwards & Lofty, 1977). Oligochaeta (Annelida; Clitellata) are one of the main

groups of benthic macroinvertebrates that make relevant contributions to aquatic food web systems.

Aquatic oligochaeta include organisms that have an intrinsic correlation to the sediment or substrate. Behavior that settles on the bottom of the waters, has relatively slow movements, and can live relatively long makes aquatic Oligochaeta have the ability to respond to water quality conditions (Zulkifli & Setiawan, 2011). The high tolerance of Oligochaeta to environmental risk factors, especially the toxic effects of metals and organic pollutants, causes Oligochaeta to be used as a bioindicator of water quality (Marchese & De Drago, 1999).

Massive entry of contaminants into the canal affects the condition of the substrate and the availability of food for aquatic Oligochaeta spatially. Currently, data information related to aquatic Oligochaeta in West Kalimantan is minimal. The process of monitoring lotic waters by the relevant City Office is still carried out using a physico-chemical approach, so that minimal continuous biological indicators are applied. Based on that, the purpose of this study was to identify and describe the types of aquatic Oligochaeta found in the canals of Sanggau City. The research results in the form of data on the type of aquatic Oligochaeta can be used comprehensively in the management of lotic waters in Sanggau City, West Kalimantan and add to the body of knowledge related to invertebrate zoology.

RESEARCH METHODS

This research was conducted in August-September 2020 in the canals of Sanggau City, West Kalimantan. Sampling was carried out at five stations with three repetitions of sampling. The five stations are located in Tanjung Sekayam Sub-District (station 1), Ilir Kota Sub-District (station 2 and 3), Beringin Sub-District (station 4) and Bunut Sub-District (station 5). The research location can also be seen on the sampling map below:

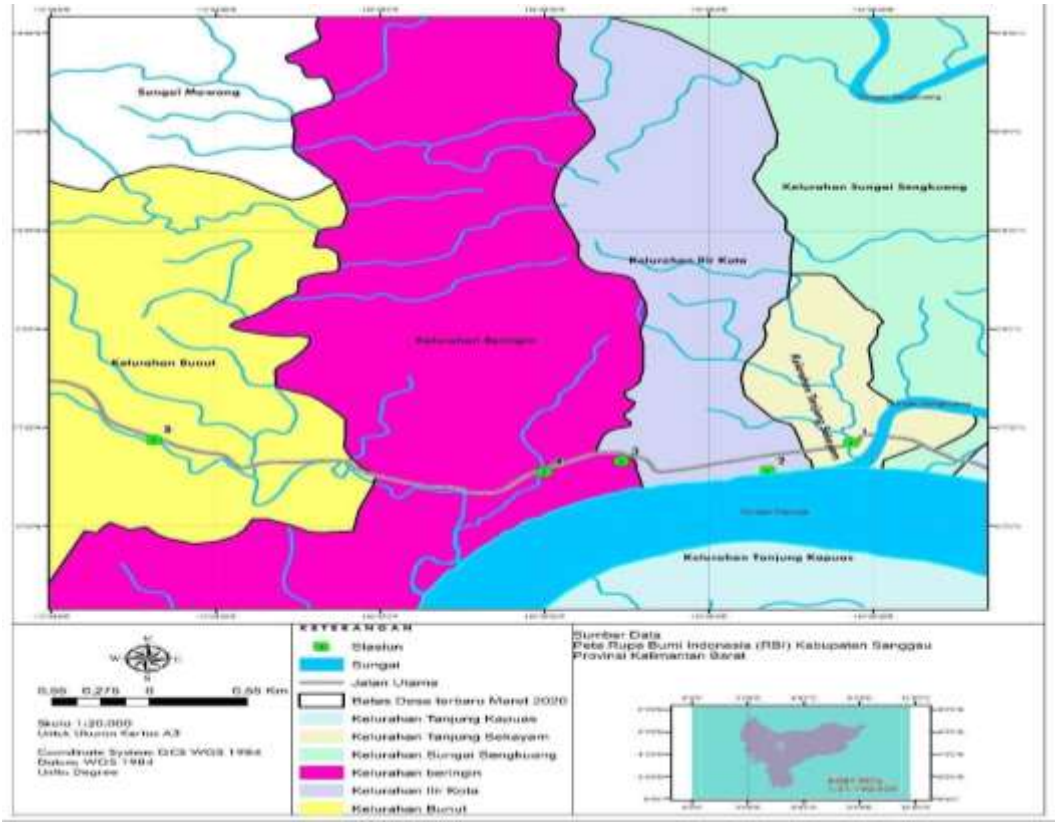

Figure 1. Map of Sampling Locations for Aquatic Oligochaeta in the Sanggau City Canal

Sampling was carried out by purposive sampling method and identification and description processes were obtained through literature studies. The tools and materials used in this research arestationery, ping pong balls, flakon bottles, Winkler bottles, boxes, petri dishes with a diameter of 9 cm, cover glass 18x18 mm, Ekman grab stainless steel size 15 cm x 15 cm, 10 L bucket, Erlenmeyer 250 ml, object glass, GPS Garmin etrex 10, pins, label paper, meter, Olympus CX 23 compound microscope, plastic tray, ATC digital pH meter, tweezers, dropper, plastic sample 25 cm x 40 cm, multilevel sieves with mesh sizes of 1 mm and 0.5 mm , Takemura DM 5 soil tester, Secchi disk, permanent marker, 3 ml syringe, raffia rope, thermometer, and tissue. The materials used during the study consisted of distilled water, 70% alcohol, 5% formalin, 0.5% starch indicator, clear nail polish, H2SO4 solution, KOH-KI solution, MnSO4 solution, and 0.025N Na-thiosulfate solution. Sediment sampling at each station using*Ekman grab*size 15x15 cm2.SThe sediment is then put in a container to be filtered using a graded sieve of 1 mm and 0.5 mm. The results of the sediment filter were given 5% formalin and then brought to the laboratory. Then the samples were sorted and identified at the Zoology Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Tanjungpura University, Pontianak. During worm sampling, in situ and ex situ water quality parameters were also measured. Water quality parameters measured in situ consist of depth measured with a scaled rope, brightness measured with*Secchi disk*, temperature measured by a thermometer, current speed measured by the float method using a ping pong ball, degree of acidity (pH) measured by a digital pH meter, and Dissolved O*xygen* (DO) and free CO2 were measured using the Winkler titrimetry method. Water quality parameters measured ex situ consisted of 3-fraction substrate analysis using the pipette method and total organic C using the*Loss on Ignition*.Furthermore, the process of identifying specimens was carried out based on morphological characters and the shape of the penis sheath according to (Brinkhurst, 1971) .Other reference books used in the identification process are Rodriguez & Reynoldson, (2011), Brinkhurst (1971), Krieger & Stearns (2010), Nesemann et al., (2004), (Brinkhurst & Diaz, 1985), Brinkhurst & Cook, (1979), Verdonschot et al., (2006), Coates et al., (1996), Rodriguez & Verdonschot, (2001), Kaster, (1989), and Reynoldson & Coates, (1994).

RESULTS AND DISCUSSION

The results of the study obtained aquatic Oligochaeta in the canals of Sanggau City, West Kalimantan, totaling 1367 individuals. The aquatic oligochaeta obtained consisted of 1 order, 1 family, 2 genera and 3 species which are presented in Table 1. The existence of aquatic Oligochaeta species found in the canals of Sanggau City at each station is presented in Table 2.

Table 1. Aquatic Oligochaeta in the Sanggau City Canal, West Kalimantan

Order	Family	genera	Species
Tubificida	Tubificidae	*Branchura*	*Branchiura sowerbyi*
		Limnodrilus	*Limnodrilus claparedianus*
			Limnodrilus hofmeisteri

The aquatic oligochaeta found in the canals of Sanggau City are not classified in terms of order, family, genera and species. The most abundant species of aquatic Oligochaeta found in the canals of Sanggau City are from the Limndorilus genera as many as 2 species and at least one species from the Branchiura genera.

Table 2. Existence of Aquatic Oligochaeta in the Sanggau City Canal, West Kalimantan

No	Species Name	St. I	St. II	St. III	St. IV	St. V	Σ
1	*Branchiura sowerbyi*	0	11	0	0	0	11
2	*Limnodrilus claparedianus*	2	8	27	127	2	166
3	*Limnodrilus hofmeisteri*	46	101	260	746	37	1190
Total		48	120	287	873	39	1367

Information:
St. : Station
Σ: Total number of species

The most common species found in the canals of Sanggau City was L. hoffmeisteri, followed by L. claparedeianus, and the least was B. sowerbyi. Species L. claparedeianus and L. hoffmeisteri are aquatic Oligochaeta found in all sampling stations, while B. sowerbyi is an aquatic Oligochaeta which is only found at one station, namely station 2 (Ilir Kota Village). The number of individual species from the least to the most was B. sowerbyi 11 individuals, L. claparedeianus 166 individuals, L. hoffmeisteri 1190 individuals.

Table 3. Habitat Characteristics of Aquatic Oligochaeta in the Sanggau City Canal

No	Parameters (unit)	Station				
		I	II	III	IV	V
1	Depth(m)	1.00	0.40	0.30	0.28	0.24
2	Current Speed (m/s)	0.04	0.36	0.15	0.07	0.40
3	Brightness(m)	0.23	0.22	0.18	0.14	0.24
4	Dissolved oxygen (mg/l)	3.0	4,2	4,6	3,6	5,8
5	Temperature (°C)	29	28	27	29	27
6	pH	6,5	6,7	6.0	6.0	6,7
7	Sand (%)	41.60	23,31	51.59	92,29	95.31
8	Mud/dust (%)	43,20	57,49	41,21	7,71	4.69
9	Clay (%)	15,20	19,20	7,20	0.00	0.00
10	C-Organic (%)	0.27	0.87	3.54	3.82	0.05

Physico-chemical Characteristics of Canal Waters in Sanggau City

The canal in Sanggau City has a depth range between 0.24 - 1 m, which indicates that there is not a big difference in the data. This condition is due to the fact that when measurements were made during the dry season, the water remained at the lowest ebb. It is known that the highest depth is found at station I which is located in Kel. Tanjung Sekayam and the lowest depth at station V which is located in Kel. Bunut. The brightness of the canal waters as measured using a secchi disk also shows quite varied values, between 0.14 - 0.24 m. The highest brightness value is at station V and the lowest is at station IV which is located in Kel. banyan The brightness of the canal waters is strongly influenced by the interaction of turbidity and depth.

Weather fluctuations that occur when measuring physico-chemical parameters cause variations in water and substrate temperatures, which range from 27-29°C. However, the temperature range obtained is still potential as a habitat for aquatic Oligochaeta. Aquatic oligochaeta also have a limiting factor that plays a role in the spreading process, namely current speed. The measurement results show that the current velocity in the Sanggau City canal ranges from 0.04-0.4 m/s. The current speed of the Sanggau City canal is influenced by variations in the depth of the canal, the lower the canal depth, the faster the current will be and vice versa. The geographical location of Sanggau City, which is an area with peat runoff, causes the waters

in it to have a fairly acidic pH. It is known that the canal waters in Sanggau City have a pH ranging from 6-7.3 and the substrate ranges from 6-6.7.

The canal in Sanggau City is composed of three types of substrate, namely sand substrate, silt substrate, and clay substrate. The percentage of sand substrate from the five stations ranged from 23.31-95.31%, silt substrate 4.69-57.49%, and clay substrate 0.00-19.20%. The type of bottom substrate in these channels will determine the level of organic matter available as food for aquatic Oligochaeta. The results of measuring the concentration of C-organic in the canals are known to range from 0.05 to 3.82%. The variation in total organic C is influenced by the amount of accumulated organic waste and the texture of the bottom substrate in the waters. Substrate dust with a fine texture has a higher ability to absorb organic matter compared to a large/coarse texture. As the sand substrate predominates at station V,

Another parameter that is no less important is the level Dissolved O_2 (DO) and free CO_2. The results of measurements of dissolved O_2 (DO) levels in the Sanggau City canal showed a range of 3-5.8 mg/l, and free CO_2 ranged from 4.29-6.6 mg/l. The level of free CO_2 in the waters affects the availability of O_2 needed by the aquatic organism community. The availability of free CO_2 in waters plays a role in the process of decomposition of organic matter by microorganisms and is the main element in the photosynthesis process of chlorophyll organisms.

Identification of Aquatic Oligochaeta in Sanggau City Canal

Identification of aquatic Oligochaeta was carried out through the process of observing the morphology and anatomy of the Oligochaeta samples obtained. Based on the results of research conducted at five stations, there are 3 species of aquatic Oligochaeta in the canals of Sanggau City. The aquatic oligochaeta in question consist of*B. sowerbyi*with a total of 11 individuals, L. claparedeianus 166 individuals, and L. hoffmeisteri 1190 individuals. All samples obtained belong to the Tubificidae family.

Branchiura sowerbyi species in the Sanggau City Canal

Classification *B. sowerbyi*and description of body parts can be seen in Figure 1 below:

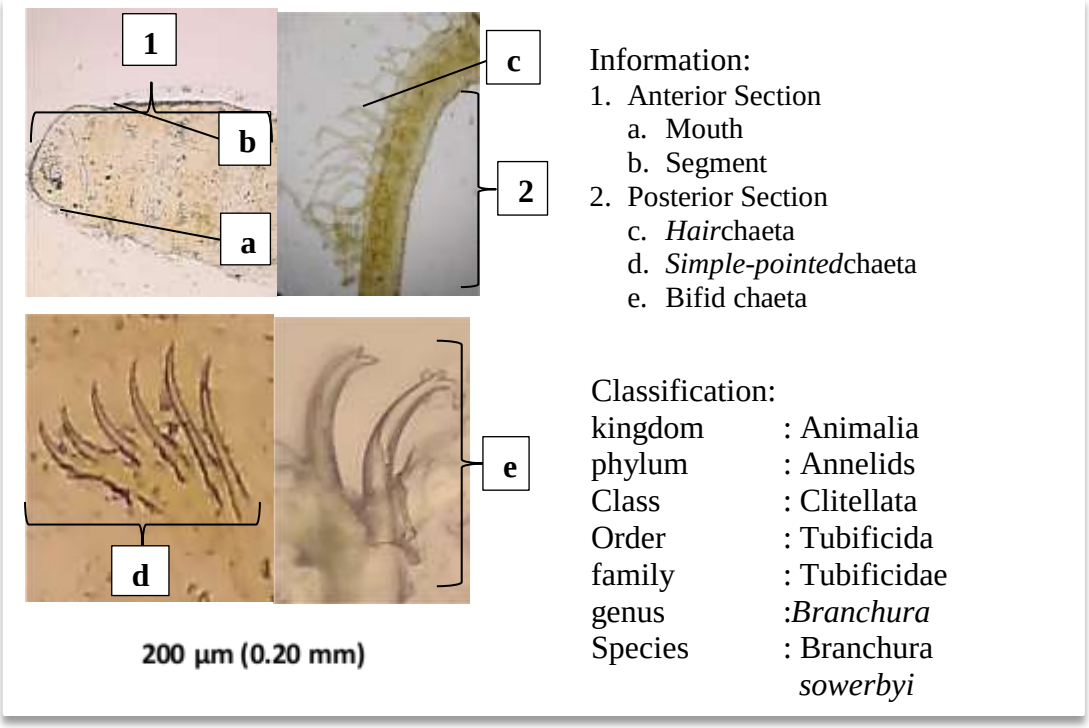

Figure 1. Branchiura sowerbyi species with 10 x 40 magnification

*B. sowerbyi*which was obtained in the canal waters of Sanggau City had a dark red body color when alive and was equipped with gills on the posterior part of the body. The gills on the posterior body are useful for obtaining oxygen and removing organic matter as a result of metabolism. B. sowerbyi is also equipped with single dorsal and single ventral setae as well as dorsal and ventral bifid setae. This species belongs to the Tubificidae group which is found in fresh water environments rich in organic matter and is found in tropical and temperate regions (Lobo & Alves, 2011). According to Bera's recearch, (2019) sowerbyi is usually found in waters with predominant smooth or muddy substrates containing organic matter. The high dust fraction will support the behavior*B. sowerbyi*mandig to a depth of 20 cm by placing the head into the substrate and the tail active on the surface (Raposeiro et al., 2009). B. sowerbyi also utilizes a soft substrate to make tubes, so that water and oxygen circulation can be obtained through its body surface.

Based on this study, B. sowerbyi belonging to the Tubificidae family was not always found at every observation station.This condition is thought to be influenced by the existence of different adaptive abilities. Unsupportive habitat due to competition for food and fluctuations in water quality causes vulnerable species to tend to die. However, more resistant species will survive and even dominate in the absence of predators. In line with the research by Labbaik et al., (2018), the existence of polluted substrates, abundance of food sources, competition between and within taxa, and disturbance from the surrounding microhabitat causes taxa that have high tolerance to increase while low tolerance will decrease.

Limnodrilus claparedeianus species in the Sanggau City Canal

Classification *L. claparedianus*along with a description of the body parts can be seen in Figure 2 below:

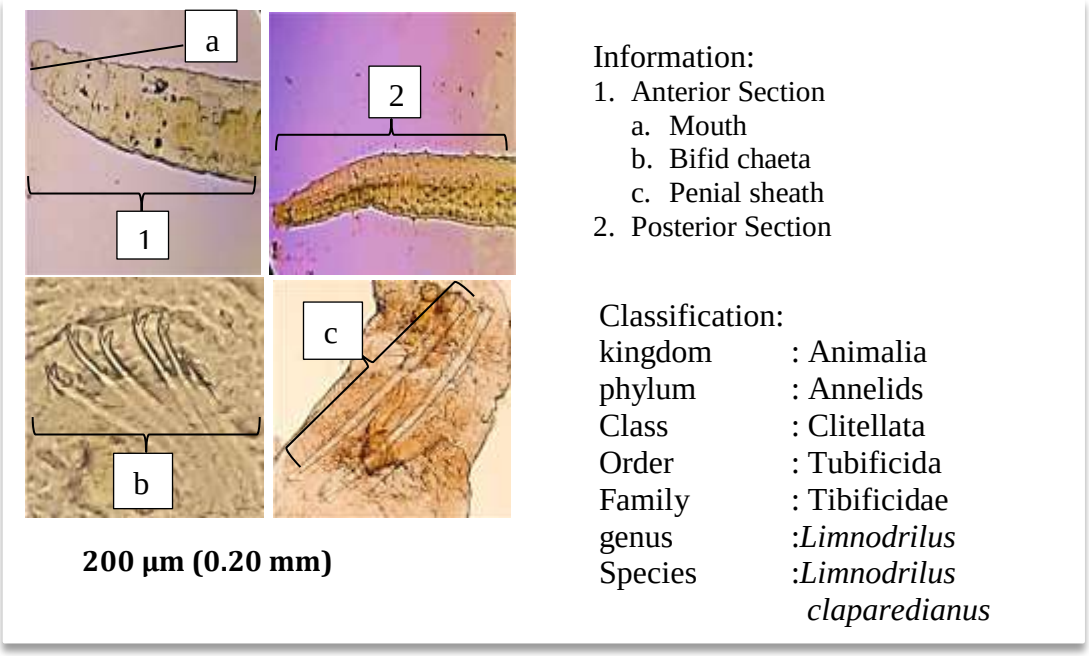

Figure 2. Limnodrilus claparedeianus species with 10 x 40 magnification

Other species of the Tubificidae family viz*L. claparedianus*and L. hofmeisteri. L. claparedeianus is a red, bilaterally symmetrical worm. During the observation process, it was known that the head of L. claparedeianus did not differentiate from prostomium. This worm is also a type of aquatic Oligochaeta which does not have eye spots. In line with L. hoffmeisteri, this species utilizes its dorsal and ventral parts in digging activities in sediments. The setae

found starting from the second body segment are all bifid in shape. This worm has a clitellum found in segments X to XII, with the penial sheath visible in segment XI being one of the main identifying characteristics.

*L. claparedianus*found at all research stations in the canals of Sanggau City with a total of 166 individuals. The high presence of the Limnodrilus genera in a habitat can represent the high availability of organic matter along with the rare interaction with predation and competition (Stephan & Alves, 2008). This is in line with the results of the study, that L. claparedeianus was most commonly found at station IV and the least at stations I and V. The high concentration of organic matter at station IV and the presence of dust fractions could support the life of L. claparedeianus in it. However, at stations I and V the concentration of organic matter was relatively low with a high sand substrate. This relates to the statement that kavailablean dust substrates with fine textures have a higher ability to absorb organic matter compared to large/coarse textures (Barus et al., 2020).

Limnodrilus hoffmeisteri species in the Sanggau City Canal

Classification *L. Hofmeisteri* along with a description of the body parts can be seen in Figure 3 below:

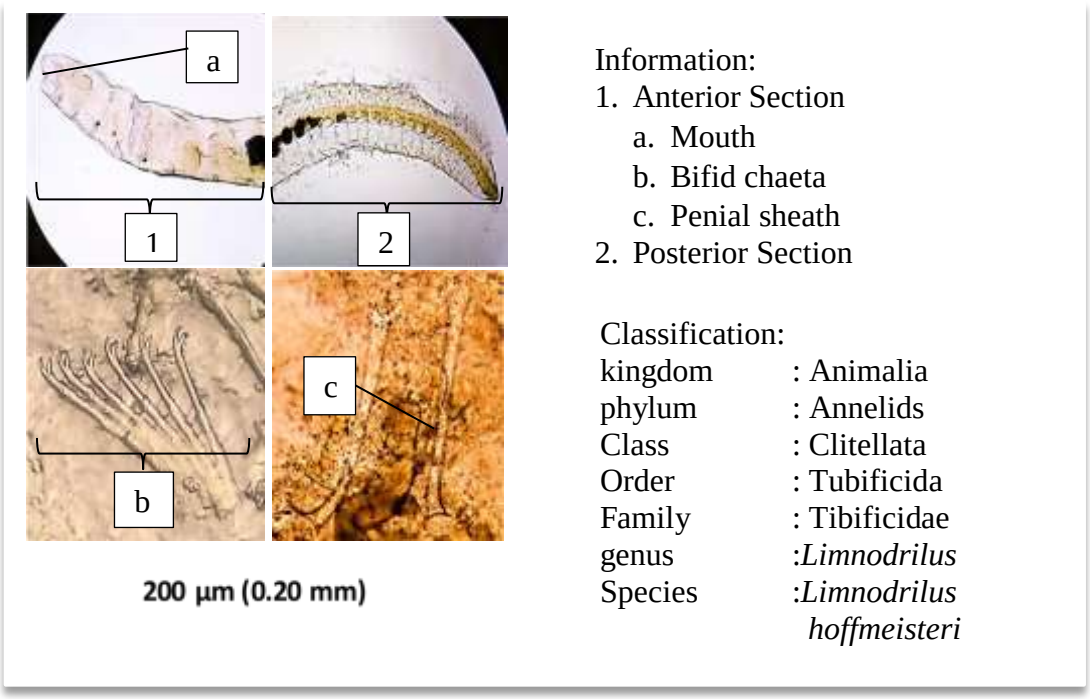

Figure 3. Limnodrilus hoffmeisteri species with 10 x 40 magnification

*L. hoffmeisteri*was the most common species found during the study, both in terms of quantity and distribution at each station. L. hoffmeisteri is a hermaphrodite worm that has a length of 20-35 mm and is equipped with body segments. This worm has a simple cone-shaped head and no eye spots. On each dorsal and ventral body segment there is a bundle of bifid setae. Seta owned by L. hofmeisteri are used in digging activities in sediments. It is known that asexually the species L. hoffmeisteri has a penial sheath or what is known as a penis sheath, this character is one of the key characters in the identification process.

*Limnodrilus*is one of the benthic animals that can live in waters polluted by organic matter (Hawkes, 1979). This high organic matter affects the availability of sufficient nutrients for the survival of aquatic Oligochaeta of the Limnodrilus genera. This is consistent with the statement

that the genus Limnodrilus (L. hoffmeisteri) is found in locations rich in organic matter and is food for Limnodrilus (Khan et al., 2007).

Based on Table 2, it is known that L. hoffmeisteri is most commonly found at station IV and the least at station V. This is because at station IV there is high organic matter (Table 3), thus supporting the presence of these species. This condition is in accordance with observations in the field, that station IV is a medium for waste streams from traditional markets that enter continuously with a substrate content of 7.71% dust. The canal depth at station IV which is less than 1 m (0.28 m) with very slow current speeds (0.07 m/s) also supports the presence of Limnodrilus in these waters. Based on research by Rusmiati et al., (2014) and Setiawan A et al., (2015), Limnodrilus is a benthic organism that lives in shallow water and if the water is too high it will have an impact on the respiration process. Slow current speedcauses fine particles to settle, abundance of detritus, and high organic matter (Fisesa ED et al., 2014), so*L. hoffmeisteri*settle and reproduce on the substrate. Its tolerant character to organic pollution and hypoxic conditions makes L. hoffmeisteri suitable for use as a biological indicator (Uzunov et al., 1998).

CONCLUSION

The aquatic oligochaeta found in the canals of Sanggau City, West Kalimantan, belong to the Tubificidae family. Oligochaeta of the branchiura genera consist of the species B. sowerbyi. The oligochaeta of the genus Limnodrilus consist of L. claparedeianus and L. hoffmeisteri.

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