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Komentar dari Reviewer :

Kategori jurnal internasional terindeks Scopus-Scimagojr. Judul karil relevan dengan scope jurnal dan bidang ilmu pengusul. Pengusul sebagai penulis pertama. Ada informasi proses review yang singkat. Received-accepted hanya satu bulan. Sebagai karil syarat khusus, diperlukan lampiran bukti korespondensi untuk memastikan bahwa proses review berjalan sesuai kriteria dalam PO PAK 2019. Unsur artikel lengkap, memenuhi kaidah IMRAD. Pembahasan substansi cukup baik, didukung kebaruan pustaka primer >80%.

Catatan:

- 1) Diperlukan bukti korespondensi untuk memastikan adanya proses review yang normal sesuai kriteria PO PAK 2019
- 2) Penilaian akan dilakukan setelah bukti ditambahkan

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Proses review berlangsung cepat karena Jurnal Biodiversitas terbit 12 kali dalam 1 tahun, sehingga. Selain itu, editor Jurnal Biodiversitas bekerja dengan sangat professional, naskah baru atau yang telah direvisi dan dikirim baik melalui email editor maupun OJS jurnal akan segera direspon dan ditindaklanjuti.

Terlampir komunikasi penulis dengan editor jurnal melalui email editor Jurnal Biodiversitas yang diprint dalam format PDF

Trophic level and position of *Pterygoplichthys pardalis* in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis

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²Department of Biology, Faculty of Science and Technology, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Jl. Ir. H. Djuanda No. 95, Ciputat, Tangerang Selatan 15412, Banten, Indonesia. Tel.: +62-21-7401925, **email: fahmawijaya@yahoo.com

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Abstract. *Elfidasari D, Wijayanti F, Sholihah A. 2020. Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis. Biodiversitas 21: 2862-2870.* The trophic level of an organism describes its sequence of natural diet visible to the food chain along with its ecosystem. This is also related to the type of diet composition and food fraction obtained by analyzing its gut content. The *Pterygoplichthys pardalis* from Ciliwung River show the diversity of the natural diet. The aims of this study is to determine the trophic level and position of *P. pardalis* in the Ciliwung River ecosystem based on gut content analysis using the purposive sampling method. Data were obtained from a total of 30 fishes from the Kalibata and Cawang areas through observations. The fishes were dissected, and gut contents were observed using a light microscope, with observations repeated 5 times of each sample. Data analysis includes relative length of gut, Index of Preponderance, area of the diet niche, niche area, niche overlap, and trophic level of an organism. The results showed that *P. pardalis* in Ciliwung River is at trophic level II, and included as herbivores ($2.00 < \text{troph} < 2.90$) that consist of Bacillariophyta (82.03%), Chlorophyta (12.7%), Cyanophyta (3.74%), Euglenophyta (1.19%), Amoebozoa (0.28%), and Dinoflagellata (0.68%).

Keywords: Ciliwung River, gut content, natural diets, *Pterygoplichthys pardalis*, trophic level

INTRODUCTION

Pterygoplichthys pardalis is an invasive species originating from Central and South America (Armbruster 2004). It migrated into Indonesia through the ornamental fish trade route. *P. pardalis* has the ability to survive under highly polluted environment due to a gastric system modification which functions as an additional respiratory organ to survive in lack of dissolved oxygen areas (Armbruster 1998). Its strong adaptations led to the abundance of native fish in the Ciliwung River. The loss rate percentage of native fish diversity in the river reached 92.5% from 1910 to 2010. This is due to the presence of *P. pardalis* (Hadiaty 2011). However, the availability of food resources is one of the factors that influence the existence of fishes. Previous studies have also established that a correlation exists between the structure of the digestive apparatus and the feeding habits of fishes (Pereira et al. 2016; Lopez-Rodriguez et al. 2019; Manna et al. 2020).

The type of diet consumed is generally influenced or determined by the morphological character of fish (Delariva and Agostinho 2001; Mazzoni et al. 2010; Pound et al. 2011; Aguilar-Betancourt et al. 2017; Winkler et al. 2017). For instance, *P. pardalis* has a suction type of ventral mouth, which allows fish to scrape food from rough surfaces (Samat et al. 2016). The shape of its mouth and its position is an adaptation pattern that aids fishes to obtain food. The position of the *P. pardalis* mouth is inferior due to its downward direction, thereby making it possible to

suck various types of food in the water base. It is also known as eaters of algae, invertebrates such as snails, detritus, and food at the bottom of the water (Mazzoni et al. 2010; Pound et al. 2011; Sharpe 2016).

Generally, members of the Loricariidae feed on diets consisting of plant fragment, zooplankton, arthropods, chlorophytes, bacillariophytes, cyanobacteria and cyanobacteria (Mazzoni et al. 2010; de Oliveira and Isaac 2013; Samat, et al. 2016; Tisasari et al. 2016; Manna et al. 2020). *Pterygoplichthys* sp. discovered in Sungai Langat, Malaysia, is known to eat algae, plants, and animal fragments (Samat et al. 2016). In addition, it relates to the availability of diet resources and the environmental state of the water. The trophic level of an animal is influenced by the composition of its diet and the trophic level of each food fraction of which data is obtained from analyzing its stomach contents (Zardo and Behr 2016; Carvalho et al. 2017; Zainordin and Hamid 2017; Lopez-Rodriguez et al. 2019).

Presently, no data explains the trophic level and position of *Pterygoplichthys pardalis* in its ecosystem in accordance with the type of natural diet contained in the river. Due to this reason, it is necessary to conduct research aimed at analyzing the trophic level of *P. pardalis* in the ecosystem of the Ciliwung River, Jakarta, Indonesia based on gut content analysis. Subsequently, information obtained from this research is useful and serves as a source of data needed to manage the Ciliwung River.

MATERIALS AND METHODS

Study area

Sampling was carried out along the Ciliwung River from the Rindam Jaya Condut area to Bidara Cina Cawang, Jakarta, Indonesia. The analysis of *Pterygoplichthys pardalis* samples was conducted at the Ecology Laboratory at the Integrated Laboratory Center, Syarif Hidayatullah State Islamic University, Jakarta, Indonesia.

This research consists of three observations and sampling stations namely St1, St2, and St3. The coordinates are as follows: St1: 06.244053°S-106.862654°E, St2: 06.25830°S-106.86040°E, and St3: 06.28599°S-106.84717°E as shown in Figure 1.

The research conducted includes collecting 30 fishes samples, which were divided into 3 groups based on its size and length, namely large (34.0-41.5 cm), medium (26.4-33.9 cm), and small fish group (18.7-26.3 cm).

Procedures

Sampling methods

The determination of the sampling point was done by using purposive sampling method, which is based on the presence of plecocs in the Ciliwung River Condut area (coordinates: 06.244053°S-106.862654°E), Kalibata area

(coordinates: 06.25830°S-106.86040°E), and Cawang area (coordinates; 06.28599°S-106.84717°E)

Relative length of gut

Measurement of the relative length of gut (RLG) is one of the methods used to distinguish fish based on the type of food they consume. It is determined by measuring the length of the digestive tract and body. Measurement of the relative length of the gut was calculated by the formula (Zuliani et al. 2016).

$$RLG = \frac{GL}{TL}$$

Where:

RLG : Relative Length of Gut

GL : Gut length

TL : Total length

The results from the measurement of the fish's RLG is distinguished in accordance with the following categorized values:

< 1 : fish classified as carnivorous

1-3 : fish classified as omnivorous

>3 : fish classified as herbivorous

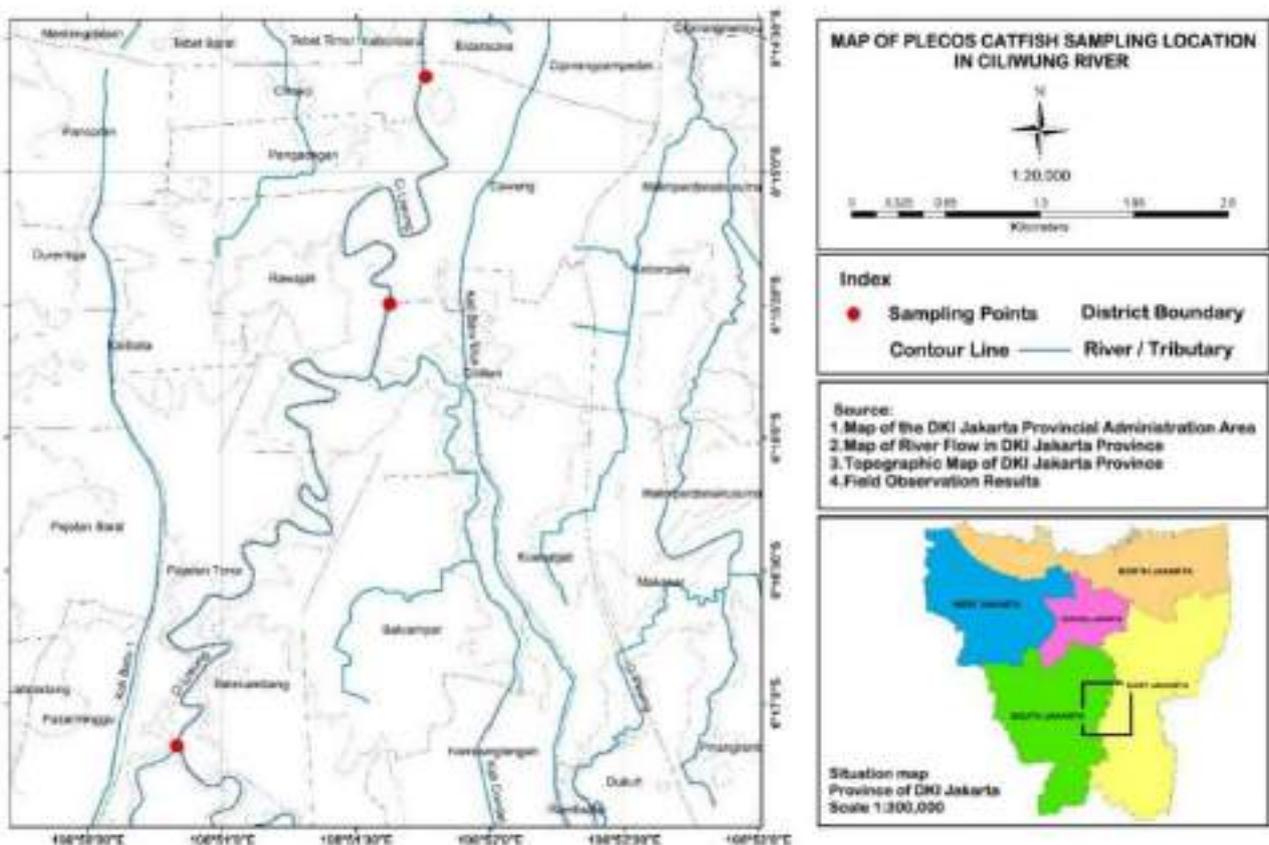


Figure 1. Three observation and sampling station along Condut-Cawang of Ciliwung River, Jakarta, Indonesia

Gut contents analysis

The observation was carried out using the dilution of the gut contents, furthermore 2 drops were placed on the slide using a pipette. The samples were viewed under a binocular light microscope with magnification ranging from 100x, 400x, and 1000x using immersion oil (Tisasari et al. 2016; Widarmanto et al. 2019).

Index of preponderance

The Index of Preponderance was used to determine the various types of plecos fish food. It is used to analyze the percentage of the largest part of the organism consumed by combining the frequency of occurrence and volumetric method using the formula (Effendie 1997).

$$IP = \frac{Vi \times Oi}{\sum(Vi \times Oi)} \times 100\%$$

Where:

IP : Index of preponderance

Vi : Volume percentage of one type of food

Oi : Frequency percentage of one type of food occurrence

$\sum(Vi \times Oi)$ = the amount of Vi x Oi of all types of food

The volumetric method is conducted by comparing the types of organisms discovered in the channel with the volume of the liquid. However, this is obtained by calculating the average species consumed, based on the number of individuals (Hyslop 1980).

The following formula determines the volume percentage of one type of food.

$$Vi = \frac{\text{number of individuals in one type of food}}{\text{total of all types of food}} \times 100\%$$

Where:

Vi: Volume percentage of one type of food

The frequency of occurrence is a simple method of collecting data in accordance with the contents of the stomach, which consists of either a particular or various types of organisms (Hyslop, 1980). The percentage of the occurrence frequency of a particular type of food is determined by the formula

$$Oi = \frac{\text{the number of tracts that contain one type of food}}{\text{as well as the total number of the stomach that contains food}} \times 100\%$$

Where:

Oi: Occurrence frequency

Based on the percentage Index of Preponderance, the food is divided into three categories

IP > 40% main food

IP 4%-40% supplementary food

IP < 4% additional food

Area of the diet niche

The area of the diet niche is measured by understanding the distribution of individual organisms which is the source

(Colwell and Futuyma 1971), in addition, it is calculated based on the food consumed by fish using the Levin Index as follows:

$$B = (\sum Pi^2)^{-1}$$

Where:

B : area of the diet niche

$\sum Pi$: total proportion of the i-th type of food consumed

Niche area

Standardisation is often used to express the diet niche area on a scale of 0 to 1, however, it is obtained by dividing the Levin Index result by the number of food types consumed by the fish.

$$Ba = \frac{B - 1}{n - 1}$$

Where:

Ba : Standardisation of levins' niche area

B : Niche area

N : Types of food consumed by fish

Niche Overlap

Niche overlap tends to occur when one or more organisms obtain food from a particular source using the following formula (Tresna et al. 2012).

$$Ch = \frac{2\sum Pij.Pik}{\sum Pij^2 + Pik^2}$$

Where:

Ch: Morisita Index

Pij, Pik: Proportion of species of i-th food organism used by two groups of j-th fish and k-th fish groups, in the same population

Trophic level of an organism

The trophic level of an organism is determined by counting the food fraction, which is obtained by the number of individuals per organism divided by the total number of individuals found in a particular group of fish with similar sizes. The trophic level is calculated with the following formula

$$Troph_i = 1 + \sum DCij \times Troph_j$$

Troph-i : Trophic level i-th fish

DCij : j-th food fraction eaten by i

Troph-j : Trophic level fraction of j-th food

Based on the analysis, the trophic level is categorized into:

2.00 < Troph < 2.9 category II fish as herbivore

2.9 < Troph < 3.7 category III fish as carnivore

3.7 < Troph < 4.5 category IV fish as carnivore

RESULTS AND DISCUSSION

Relative length of gut of *Pterygoplichthys pardalis* from Ciliwung River

The results from the analysis of the relative length of gut (RLG) showed that the *P. pardalis* found in the Ciliwung River is included in the category of herbivorous fish. This is observed in the RLG values for each group of fish. The RLG from large to small fish groups are 10,98 cm, 11,17 cm, and 17,49 cm, respectively. Based on these values, *P. pardalis* is included in the category of RLG > 3, as shown in Table 1.

The relative length of the gut is used as an indicator of the fish's feeding habits by comparing its length to the total length (Hyslop 1980; Delariva and Agostino 2001; Lujan et al. 2012; Sampaio et al. 2013). According to research conducted by Tisasari, fish classified as herbivores usually have a total gut length of 5.9 times the body length (Tisasari, et al. 2016). Gut length is influenced by the fish's feeding patterns, which is observed in the relationship between the diet type and the gut length. *Rhinelepis aspera* has a significantly different gut length from *Megalancistrus aculeatus* because it has an entirely different diet type, however, both are species of Loricariidae (Delariva and Agostinho 2001).

Pterygoplichthys pardalis has a relatively long gut and is classified as herbivore however, and digestion lasts longer compared to fish in the other groups. The structure of the gut shows a strong adaptation to any diet type. Plecos fish diet type includes plant fragments, algae, and detritus. Algae and detritus are hard to digest and require longer mechanical power. The digestive process requires a large area for absorption, and this causes elongates the gut of the pleco (Armbruster 1998; Pound et al. 2011; Samat et al. 2016).

Pterygoplichthys pardalis gut content in Ciliwung River

The results from the analysis of the gut content of *P. pardalis* in the Ciliwung River showed that the various

types of natural fish diet are grouped into Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta, Amoebozoa, Dinoflagellata, and detritus (Table 2). Bacillariophyta is commonly found in the guts of plecos fish compared to the others. Conversely, these groups were discovered in as many as 59 genera. Generally, the Bacillariophyta group is found in sediments and substrates of both mild and strong currents (Genkal and Yarushina 2014; Genkal and Yarushina 2016). This is consistent with the feeding behavior of *P. pardalis* as a bottom feeder fish, because this group is a type of phytoplankton that is widely attached to sediments or substrates (Lujan et al. 2012; Genkal and Yarushina 2014; Genkal and Yarushina, 2016; Manna et al. 2020). The type of diet consumed by *P. pardalis* determines the feeding habits in the Ciliwung River.

The results from the gut content analysis, showed that the calculated percentage of natural diet consumed by *P. pardalis* is 82.03% Bacillariophyta. Therefore, it is the commonest type of natural diet, with Chlorophyta, Cyanophyta, Euglenophyta, Amoebozoa, Dinoflagellata, and detritus at 12.17%, 3.74%, 1.19%, 0.28%, 0.68%, and 0% (Figure 2).

Bacillariophyta is used as the primary source of the natural diet for the *P. pardalis* in the Ciliwung River because its habitat is at the bottom of the water, and it supports the characteristics of the mouth shape of plecos fish. According to the results from the study conducted by Pambudi in 2015, Bacillariophyta had the highest abundance compared to other divisions found in the river, followed by Chlorophyta (Pambudi et al. 2016).

Table 1. Relative length of gut in each fish category

Fish categories	Total length (TL)	Gut length (GL)	RLG (cm)
Large fish	37.03	406.75	10.98
Medium fish	31.73	354.6	11.17
Small fish	21.64	378.53	17.49

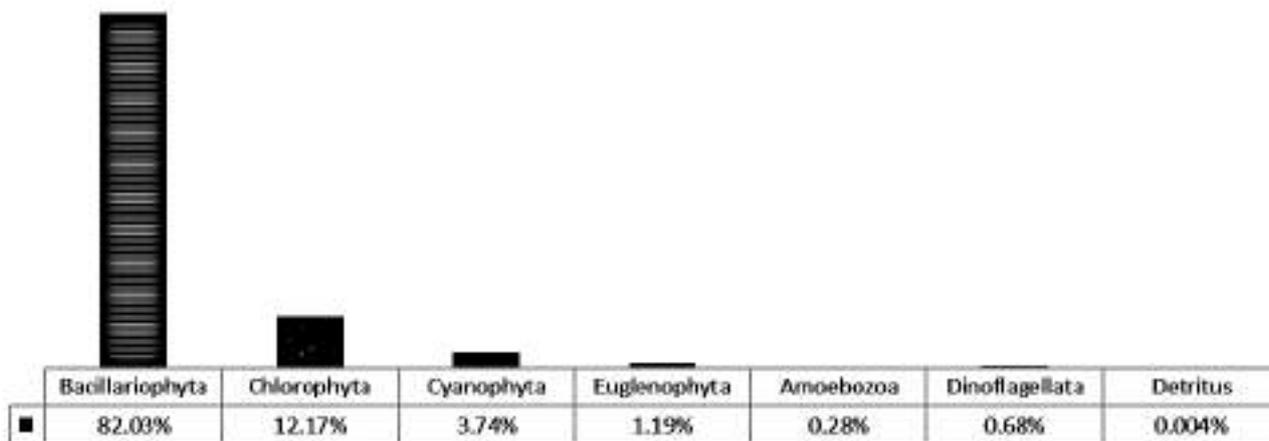


Figure 2. Percentage of *Pterygoplichthys pardalis* natural diet in the Ciliwung River, Jakarta, Indonesia based on gut content analysis

Plecos consume phytoplankton, zooplankton and detritus as its main (56.39%), supplementary (36.94%) and additional (6.67%) diets. These results are similar to those obtained in the previous studies which stated that pleco's main diet is Bacillariophyta, Chlorophyta, while Cyanophyta and Eugleophyta, Xanthophyta, Crustacea are additional diets (de Oliveira and Isaac 2013; Tisasari et al. 2016; Manna et al. 2020). The dissimilarities in the feeding habits of fishes tend to occur as a result of the differences in the availability of food utilized in its natural habitat. According to Effendi, fish's preference for diet is relative (Effendie 1997). Additionally, the distribution of food organisms, availability of natural diet, and physical conditions tend to influence their feeding habits (Garcia et al. 2018; Wei et al. 2018; Manna et al. 2020). Therefore, greater availability of food resources in the invaded habitats provided conditions that are conducive for the establishment of non-native species (Delariva and Agostinho 2001; Pound et al. 2011; Garcia et al. 2018).

***Pterygoplichthys pardalis* Index Preponderance in Ciliwung River**

Index Preponderance (IP) explains the natural diet preferences of *P. pardalis*. Subsequently, IP based on the different types of fish groups shows similar diet preferences. The three groups of *P. pardalis* utilizes Bacillariophyta as its main natural food. The IP values of Bacillariophyta in the large, medium, and small fish groups are 86.70%, 78.66%, and 81.11% (Figure 2). The

preference of Bacillariophyta as the main natural diet for *P. pardalis* shows that its availability in the river is quite abundant. In addition, it is a type of microalgae that is epilithic, thereby making it is suitable for *P. pardalis*. Morphologically, *P. pardalis* has a triangular mouth shape suited towards the ventral that supports its feeding habits. This is due to the fact that it belongs to the group of algae-feeding fish that covers the bottom surface of the water. The morphology of the mouth's shape and structure allows the fish to erode food from hard surfaces and swallow soft sediments efficiently (Armbruster 2004; Samat et al. 2016; Manna et al. 2020).

The IP value of Chlorophyta in the large, medium, and small fish groups are 6.87%, 17.27%, and 12.40%, respectively. Conversely, the IP value of Cyanophyta in the large, medium, and small fish groups are 5.24%, 1.87%, and 4.11% (Figure 3). This showed that they are a type of natural supplementary diet for *P. pardalis* in the Ciliwung River. The abundance of Cyanophyta in the river ranks third after Bacillariophyta and Chlorophyta (Pambudi et al. 2016). This statement is supported by the results from the research which stated that Chlorophyta and Cyanophyta discovered in the guts of plecos fish in the Langat River, are relatively abundant in the habitat (Samat et al. 2016). Fishes generally adjust the food types to the size of their mouth openings, while the larger ones tend to consume more food (Zuluaga-Gomez et al. 2016; Aguilar-Betancourt et al. 2017; Winkler et al. 2017).

Table 2. The composition of the *Pterygoplichthys pardalis* natural diets in the Ciliwung River, Jakarta, Indonesia in accordance with gut content analysis.

Category	Type
Bacillariophyta	<i>Achnanthes</i> sp., <i>Achnantheidium</i> sp., <i>Amphipleura</i> sp., <i>Amphora</i> sp., <i>Aneumastus</i> sp., <i>Aulacoseira</i> sp., <i>Bacillaria</i> sp., <i>Caloneis</i> sp., <i>Climacosphenia</i> sp., <i>Cocconeis</i> sp., <i>Craticula</i> sp., <i>Cyclotella</i> sp., <i>Cymbella</i> sp., <i>Cymbopleura</i> sp., <i>Diademesis</i> sp., <i>Diatoma</i> sp., <i>Diploneis</i> sp., <i>Encyonema</i> sp., <i>Entophysalis</i> sp., <i>Encyonopsis</i> sp., <i>Eolimna</i> sp., <i>Eunotia</i> sp., <i>Ephitemia</i> sp., <i>Fallacia</i> sp., <i>Fragilaria</i> sp., <i>Frustulia</i> sp., <i>Geissleria</i> sp., <i>Gomphoneis</i> sp., <i>Gomphonema</i> sp., <i>Grammatophora</i> sp., <i>Gyrosigma</i> sp., <i>Halamphora</i> sp., <i>Hantzschia</i> sp., <i>Luticola</i> sp., <i>Lemnicola</i> sp., <i>Lyrella</i> sp., <i>Mastogloia</i> sp., <i>Melosira</i> sp., <i>Navicula</i> sp., <i>Neidium</i> sp., <i>Nepula</i> sp., <i>Nitzschia</i> sp., <i>Oedogonium</i> sp., <i>Pinnularia</i> sp., <i>Placoneis</i> sp., <i>Planothidium</i> sp., <i>Prestauroneis</i> sp., <i>Rhoicospenia</i> sp., <i>Rivularia</i> sp., <i>Rhopalodia</i> sp., <i>Sellaphora</i> sp., <i>Stauroneis</i> sp., <i>Stenopterobia</i> sp., <i>Stephanodiscus</i> sp., <i>Surirella</i> sp., <i>Synedra</i> sp., <i>Tabularia</i> sp., <i>Tryblionella</i> sp., <i>Ulnaria</i> sp.
Chlorophyta	<i>Ankistrodesmus</i> sp., <i>Asterococcus</i> sp., <i>Bulbochaete</i> sp., <i>Chlamydomonas</i> sp., <i>Chlorella</i> sp., <i>Chlorococcum</i> sp., <i>Chlorococcus</i> sp., <i>Closterium</i> sp., <i>Choricystis</i> sp., <i>Coleastrum</i> sp., <i>Cosmarium</i> sp., <i>Crucigenia</i> sp., <i>Desmodesmus serratus</i> , <i>Dictyochloropsis</i> sp., <i>Dictyococcus</i> sp., <i>Dictyosphaerium</i> sp., <i>Eudorina</i> sp., <i>Haematococcus</i> sp., <i>Microspora</i> sp., <i>Monoraphidium</i> sp., <i>Oocystis</i> sp., <i>Oophila</i> sp., <i>Palmellopsis</i> sp., <i>Pediastrum</i> sp., <i>Planktosphaeria</i> sp., <i>Scenedesmus</i> sp., <i>Selenastrum</i> sp., <i>Staurastrum</i> sp., <i>Steogclonium</i> sp., <i>Tetrastrum</i> sp., <i>Tetraedron</i> sp., <i>Tetraspora</i> sp., <i>Volvox</i> sp., <i>Zygnema</i> sp.
Cyanophyta	<i>Anabaena</i> sp., <i>Aphanizomenon</i> sp., <i>Aphanocapsa</i> sp., <i>Aphanothece</i> sp., <i>Arthrospira</i> sp., <i>Chlorogloea</i> sp., <i>Chroococcus</i> sp., <i>Gloeocapsa</i> sp., <i>Gloeocapsopsis</i> sp., <i>Gloeocystis</i> sp., <i>Gloeotheca</i> sp., <i>Gloeothichia</i> sp., <i>Merismopedia</i> sp., <i>Neosporiocolobium</i> sp., <i>Nostoc</i> sp., <i>Phormidium</i> sp., <i>Pseudocapsa</i> sp., <i>Pseudonabaena</i> sp., <i>Rivularia</i> sp., <i>Synechococcus</i> sp., <i>Tychonema</i> sp.,
Euglenophyta	<i>Euglena</i> sp., <i>Lepocinclis</i> sp., <i>Phacus</i> sp., <i>Trachelomonas</i> sp., <i>Waillesella</i> sp.
Amoebozoa	<i>Arcella</i> sp., <i>Centropyxis</i> sp., <i>Clypeolina</i> sp., <i>Pyxidicula</i> sp.,
Dinoflagellata	<i>Prorocentrum</i> sp.
Detritus	<i>Meliola</i> sp., <i>Pestaliotiopsis</i> sp.

The IP analysis obtained, showed that *P. pardalis* is included in the opportunist fish group because it is able to utilize the food available in the river. Plecos fish consumes phytoplankton as its main food (56.39%), while zooplankton serves its supplementary food (36.94%) and detritus as the additional food (6.67%) (Tresna et al. 2012). However, *P. pardalis* consumes Bacillariophyta as its main food, Chlorophyta and Cyanophyta, as its supplementary foods, while Euglenophyta, Xanthophyta, *Crustacea* serves as additional foods (Mazzoni et al. 2010; Lujan et al. 2012; Samat et al. 2016; Tisasari et al. 2016; Manna et al. 2020). The differences in feeding habits of a particular type of fish tend to occur due to dissimilarities in the availability of food utilized in its natural habitat. Distribution of diet organisms, availability of food in the habitat, species of fish, and physical conditions influences feeding habits (de Oliveira and Isaac 2013; Perpetua et al. 2013; Sofarini, et al. 2019). It is also influenced by competition between individuals, predators, food chains from broad areas, and overlapping food niches (Effendi 2003; Pound et al. 2011; Manna et al. 2020).

Feeding niches area

The feeding niches area is a description of the proportion of the various food consumed by a particular type of fish (Mazzoni et al. 2010; Abilhoa et al. 2016; Hossain et al. 2018). The area of the feeding niche showed the size of the fish group that utilizes the available organisms as its natural diet source. In addition, it also utilizes aquatic resources (de Oliveira and Isaac 2013; Lopez-Rodriguez et al. 2019; Manna et al. 2020). Analysis of the feeding niche area is determined by the number and size of the different types of individuals in each group (Westerborn et al. 2018; Zhang et al. 2019). Standardization is conducted to obtain a broad variety of niches ranging from 0-1 intervals between variables that are not similar (Izzani 2012; Allgeier et al. 2017).

The results from the analysis of *P. pardalis* feeding niche area in the Ciliwung River in accordance with the group differences show that the large fish group has a larger niche area 42,87 compared to the other groups with

standardization of 0.22 (Table 3). The huge value is expected because the fish are able to utilize the resources available in large quantities. However, this value is influenced by the number of the different types of food consumed by a particular group of fish with a relatively large niche area tends to have an increased number of species that are utilized as their food sources (Tresna et al. 2012; Pereira et al. 2016). It also implies that the fish group tends to evenly utilize all available resources in the aquatic environment as their natural diets. Besides, the size of the fish also affects the external diet niche. The feeding niche area for fishes is influenced by its length and size in their habitats (Armbruster 1998; Samat et al. 2016; Lopez-Rodriguez et al. 2019; Manna et al. 2020).

The medium size fish group has a niche value of 36.01 with standardization of 0.19 (Table 3). This value is lower than that of the large fish group, and its decrease is due to the differences in the utilization of diet resources in the river. Therefore, fish with a lower niche area means that its group tends to be more selective in utilizing resources (Moody et al. 2019; Zhang et al. 2019).

The small size fish group has a lower niche area value of 16.78 with 0,07 standardization as shown in Table 3, because it uses food selectively. Fish that have a relatively small niche area uses less food types, and they specialize in utilizing diet resources (Sentosa and Satria, 2015; Garcia et al. 2018; Mwijage et al. 2018).

The joint use of available diet resources by the fish size groups tends to cause overlapping niches. Overlapping occurs when the food resources are shared by two or more types of fish (Sentosa and Satria 2015; Aguilar-Betancourt et al. 2017; Westerborn et al. 2018).

Table 3. The area of niches and standardization in each size category

Category	Size	Niche area	Standardization
Large fish	340-415 mm	42.87	0.22
Medium fish	264-339 mm	36.01	0.19
Small fish	187-263 mm	16.78	0.07

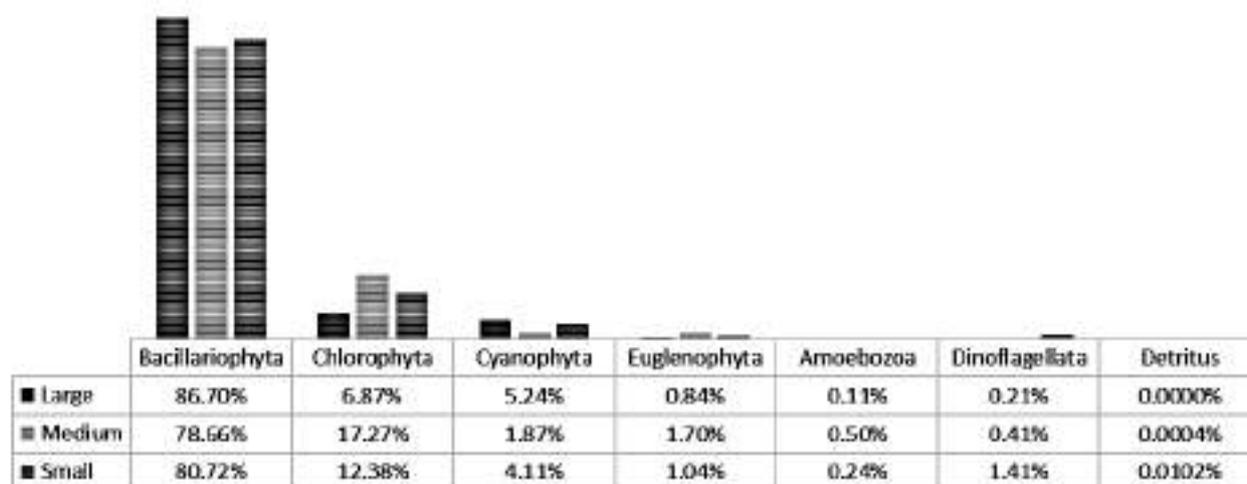


Figure 3. Index Preponderance of natural diet in each group of *Pterygoplichthys pardalis* in the Ciliwung River, Jakarta, Indonesia**Table 4.** The intraspecific overlapping value between fish groups

Category	Large	Medium	Small
Large		0.77	0.42
Medium			0.43
Small			

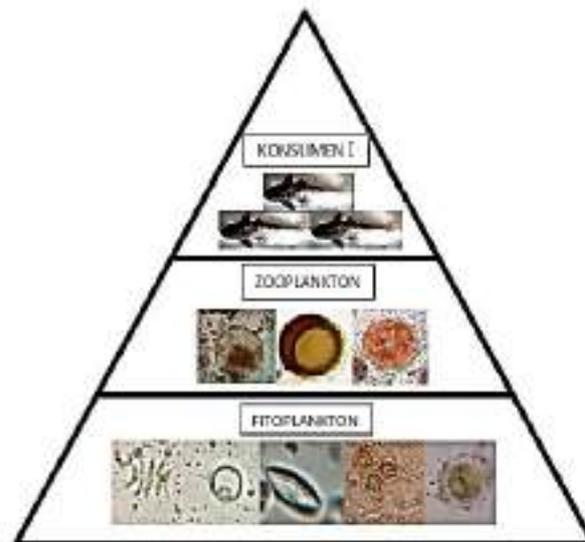
The results from the analysis of overlapping niches showed that the relationship between the large and medium fish groups has a greater value (0.77) compared to that of other groups (Table 4). The value of overlapping niches implies the presence of organisms that are shared between the groups. It also shows the similarity in resource utilization of 0.77. High overlapping values cause large and medium fish groups to compete for food.

The overlapping relationship between large and small fish groups is 0.42, and that of the medium and small fish groups have a similarity value of 0.43 (Table 4). This means that the overlapping relationship between the medium and small groups, large and small groups, is lower compared to that between large and medium groups. The low value showed that there are differences in the organisms used. In addition, it is suspected that this reason led to a huge increase in the number of small and medium fish that was simultaneously discovered in the Kalibata area.

The value of overlapping feeding niches is approximately one (1). This means that similar resources are used which caused the 2 groups of fish to be highly competitive between two groups of fish. Overlapping values that are approximately zero (0) showed the differences in diet types between the two groups. Furthermore, overlapping of niches tends to occur when there are similarities in the diet types that are shared by two or more groups of fish (Izzani 2012; de Oliveira and Isaac 2013). The overlapping values of each group tend to trigger interactions or compete for food in the same location (Faria et al. 2018; Westerborn et al. 2018; Beuttner and Koch 2019).

***Pterygoplichthys pardalis* trophic level in the Ciliwung River**

The results from the analysis of the trophic level of *P. pardalis* in the Ciliwung River show no difference in each of the groups. The value of *P. pardalis* trophic level in the river is 2.00, which means that it is classified as group II herbivorous fish. This is in accordance with the trophic level category values ($2.00 < \text{trophic} < 2.90$). Herbivorous fish belong to group II because they eat phytoplankton, which is a type of food fraction at the trophic level of group I (Figure 4). Fish species classified as herbivores consume plants, phytoplankton, and detritus (Thompson et al. 2015; Samat et al. 2016; Manna et al. 2020). The analysis of trophic level supports Samat's statement that plecos fish have long guts and belong to the herbivorous group that feeds on algae and detritus besides, the environmental conditions are important for diet composition (Armbruster 2004; Samat et al. 2016; Manna et al. 2020).

**Figure 4.** The trophic level of plecos fish in Ciliwung River, Jakarta, Indonesia

Pterygoplichthys pardalis is classified as a level I consumer and belongs to the herbivorous group, however, this causes it to compete with native fish for food. According to Tresna, Wader (*Mystacoleucus marginatus*) and silver rasbora (*Rasbora argyrotaenia*) are native fish from Cimanuk river, Garut subsequently, the composition of their natural diet consist of plankton, plant fragments, and detritus (Tresna et al. 2012). Native fish tend to compete with *P. pardalis* due to the composition of a natural diet in the feeding habitat. The ability of fish to adapt to environmental conditions is a determinant of its adaptation in the river (Eya et al. 2011; Sofarini et al. 2019; Manna et al. 2020). *P. pardalis* is able to survive in a polluted aquatic environment, however, it is also supported by morphological characters, such as an additional respiratory organ that functions as a respirator in poorly dissolved oxygen conditions (Armbruster 1998; Moroni 2015). These fish possess hard and prickly scales therefore there are no predators in the waters (Hadiaty 2011). The migration of *P. pardalis* in the waters of the Ciliwung River disrupted the food chain due to their feeding habits because they tend to feed on benthic algae and compete with native fish (Pound et al. 2011; Rao, 2017; Orfinger and Goodding 2018; Wei et al. 2018; Hossain et al. 2018).

In conclusion, the *P. pardalis* belongs to the group II ($2.00 < \text{trophies} < 2.90$) trophic level and is classified as a herbivorous fish in the ecosystem of the Ciliwung River. The composition of its natural diet consists of Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta, Dinoflagellata, Amoebozoa, and detritus in the riverbed with Bacillariophyta as its main natural diet at a preference value of 82.03% (IP > 40%). Meanwhile, its supplementary diet consists of 12.17% (IP < 40%) of Chlorophyta and additional diet (IP < 40%) of Cyanophyta (3.74%), Euglenophyta (1.19%), Amoebozoa (0.28%), Dinoflagellata (0.68%) and detritus 0.00%.

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Trophic level and Position of *Pterygoplichthys pardalis* in Ciliwung River ecosystem based on the gut content analysis

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Abstract. The trophic level of an organism describes its sequence of natural diet visible to the food chain along with its ecosystem. This is also related to the type of diet composition and food fraction obtained by analyzing its gut content. The *Pterygoplichthys pardalis* from Ciliwung River show the diversity of the natural diet. However, no information has been provided on its trophic level in the ecosystem. This study, therefore, aims to determine the trophic level and position of *Pterygoplichthys pardalis* in the Ciliwung River ecosystem based on the gut content analysis using the purposive sampling method. Data were obtained from a total of 30 fishes from the Kalibata and Cawang areas through observations. The fishes were dissected, and gut contents were observed using a light microscope, with observations repeated 5 times of each sample. The results showed that *Pterygoplichthys pardalis* in Ciliwung River is at trophic level II, and included as herbivores ($2.00 < \text{troph} < 2.90$) that consist of Bacillariophyta (82.03%), Chlorophyta (12.7%), Cyanophyta (3.74%), Euglenophyta (1.19%), Amoebozoa (0.28%), and Dinoflagellata (0.68%).

Key words: Ciliwung River, gut content, natural diets, *Pterygoplichthys pardalis*, trophic level

Running title: Trophic level of *P. pardalis* in Ciliwung

INTRODUCTION

Pterygoplichthys pardalis is an invasive species originating from Central and South America (Armbruster, 2004). It migrated into Indonesia through the ornamental fish trade route and has the ability to survive under highly polluted environment, due to a modification in its gastric system which functions as an additional respiratory organ that aids it to survive in areas that lack dissolved oxygen (Ambruster, 1998). Its strong adaptations led to the abundance of native fish in the Ciliwung River. The percentage loss rate of native fish diversity in the river reached 92.5% from 1910-2010. This is due to the presence of *Pterygoplichthys pardalis* (Hadiaty, 2011). However, the availability of food resources is one of the factors that influence the existence of fishes. Previous studies have also established that a correlation exists between the structure of the digestive apparatus and the feeding habits of fishes (Manna, et al., 2020).

The type of diet consumed is generally influenced or determined by the morphological character of species (Mazzoni, et al., 2010; Delariva & Agostinho, 2001). For instance, *Pterygoplichthys pardalis* has a suction type of ventral mouth, which allows fish to scrape food from rough surfaces (Samat, et al., 2016). The shape of its mouth and its position is an adaptation pattern that aids fishes to obtain food. The position of the *Pterygoplichthys pardalis* mouth is inferior due to its downward direction, thereby making it possible to suck various types of food in the water base. It is also known as eaters of algae, invertebrates such as snails, detritus, and food at the bottom of the water (Sharpe, 2016) (Mazzoni, et al., 2010).

Generally, members of the Loricariidae feed on diets consisting of plant fragment, zooplankton, arthropods, chlorophytes, bacillariophytes, cyanobacteria and cyanobacteria (Manna, et al., 2020); (Tisasari, et al., 2016); (de Oliveira & Isaac, 2013); (Mazzoni, et al., 2010). *Pterygoplichthys sp* discovered in Sungai Langat, Malaysia, is known to eat algae, plants, and animal fragments (Samat, et al., 2016). In addition, it relates to the availability of diet resources and the environmental state of the water. The trophic level of an animal is influenced by the composition of its diet and the trophic level of each food fraction of which data is obtained from analyzing its stomach contents (Mearns, 1981).

Presently, no data explains the trophic level and position of *Pterygoplichthys pardalis* in its ecosystem in accordance with the type of natural diet contained in the river. Due to this reason, it is necessary to conduct research aimed at analyzing the trophic level of *Pterygoplichthys pardalis* in the ecosystem of the Ciliwung River based on gut content analysis. Subsequently, information obtained from this research is useful and serves as a source of data needed to manage the Ciliwung River.

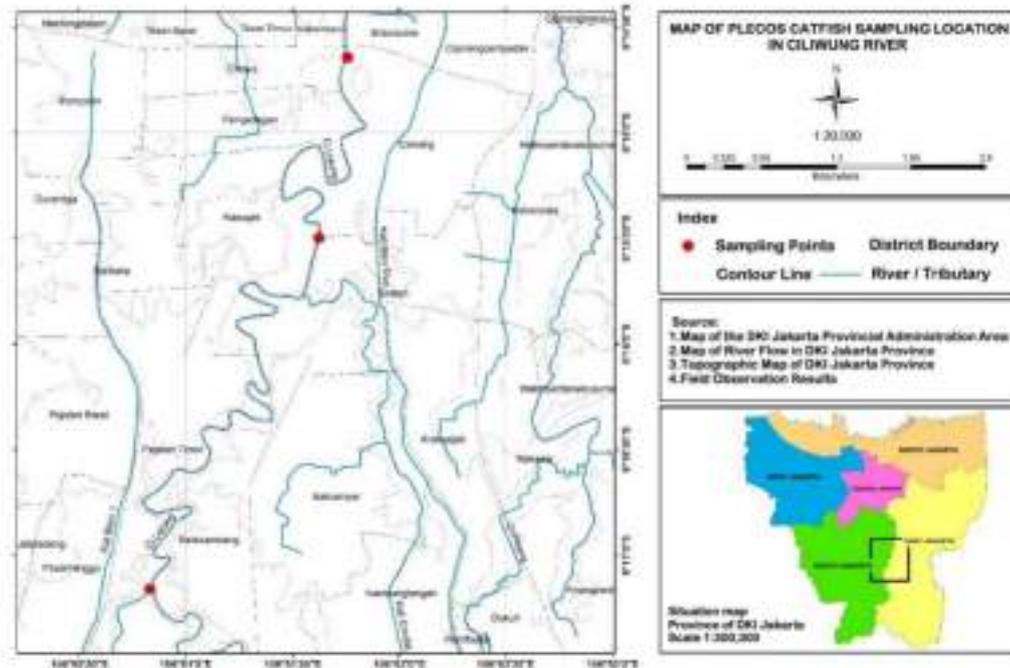
47

MATERIALS AND METHODS

48 Study area

49 Sampling was carried out along the Ciliwung River from the Rindam Jaya area to Bidara Cina. The analysis of fish
50 samples was conducted at the Ecology Laboratory at the Integrated Laboratory Center, Syarif Hidayatullah State Islamic
51 University Jakarta.

52 This research consists of three observations and sampling stations namely St1, St2, and St3. The coordinates are as
53 follows: St1 S 06.244053°-E 106.862654°, St2 S 06.25830°-E 106.86040°, and St3 S 06.28599°-E 106.84717° as shown
54 in Figure 1.



55

56 **Figure 1:** Three observation and sampling station along Cawang-Condet of Ciliwung River

57

58 The research conducted includes collecting fish samples, which were divided into 3 groups based on its size and length,
59 namely large (34,0-41,5 cm), medium (26,4-33,9 cm), and small fish group (18,7-26,3 cm).

60 Procedures

61 Sampling methods

62 The determinant of the sampling point is done by using purposive sampling method, which is based on the presence of
63 plecos in the Ciliwung River Kalibata area (coordinates: S 06.244053°-E 106.862654°) and Cawang (coordinates; S
64 06.28599°-E 106.84717°)

65 Relative Length of Gut

66 Measurement of the relative length of gut (RLG) is one of the methods used to distinguish fish based on the type of
67 food they consume. It is determined by measuring the length of the digestive tract and body. Measurement of the relative
68 length of the gut was calculated by the formula (Zuliani, et al., 2016).

$$69 \quad RLG = \frac{GL}{TL}$$

70

71 Note:

72 RLG = Relative Length of Gut

73 GL = Gut length

74 TL = Total length

75 The results from the measurement of the fish's RLG is distinguished in accordance with the following categorized values

76 < 1 = fish classified as carnivorous

77 1-3 = fish classified as omnivorous

78 >3 = fish classified as herbivorous

79 *Gut Contents Analysis*

80 The observation was carried out using the dilution of the gut contents, furthermore 2 drops were placed on the slide
81 using a pipette. The samples were viewed under a binocular light microscope with magnification ranging from 100x,
82 400x, and 1000x using immersion oil (Tisasari, et al., 2016); (Widarmanto, et al., 2019)

83 *Index of Preponderance*

84 The Index of Preponderance was used to determine the various types of plecos fish food. It is used to analyze the
85 percentage of the largest part of the organism consumed by combining the frequency of occurrence and volumetric method
86 using the formula (Effendie, 1997).

87

$$88 \quad IP = \frac{Vi \times Oi}{\sum(Vi \times Oi)} \times 100\%$$

89

90 Note:

91 IP = *Index of Preponderance*

92 Vi = volume percentage of one type of food

93 Oi = frequency percentage of one type of food occurrence

94 $\sum(Vi \times Oi)$ = the amount of Vi x Oi of all types of food

95

96 The volumetric method is conducted by comparing the types of organisms discovered in the channel with the volume
97 of the liquid. However, this is obtained by calculating the average species consumed, based on the number of individuals
98 (Hyslop, 1980).

99 The following formula determines the volume percentage of one type of food.

100

101

$$102 \quad Vi = \frac{\text{number of individuals in one type of food}}{\text{total of all types of food}} \times 100\%$$

103

104 Note:

105 Vi = Volume percentage of one type of food

106

107 The frequency of occurrence is a simple method of collecting data in accordance with the contents of the stomach,
108 which consists of either a particular or various types of organisms (Hyslop, 1980). The percentage of the occurrence
109 frequency of a particular type of food is determined by the formula

110

$$111 \quad Oi = \frac{\text{the number of tracts that contain one type of food}}{\text{as well as the total number of the stomach that contains food}} \times 100\%$$

112

113 Note:

114 Oi = Occurrence frequency

115 Based on the percentage Index of Preponderance, the food is divided into three categories

116 IP > 40% main food

117 IP 4%-40% supplementary food

118 IP < 4% additional food

119 *Area of the diet niche*

120 The area of the diet niche is measured by understanding the distribution of individual organisms which is the source
121 (Colwell & Futuyma, 1971), in addition, it is calculated based on the food consumed by fish using the Levin Index as
122 follows:

$$123 \quad B = (\sum Pi^2)^{-1}$$

124

125 Note:

126 B = area of the diet niche

127 $\sum Pi$ = total proportion of the i-th type of food consumed

128 *Niche Area*

129 Standardisation is often used to express the diet niche area on a scale of 0 to 1, however, it is obtained by dividing the
130 Levin Index result by the number of food types consumed by the fish.

$$Ba = \frac{B - 1}{n - 1}$$

131
132

Note:

Ba = Standardisation of levins' niche area

B = Niche area

N = Types of food consumed by fish

137
138
139
140

Niche Overlap

Niche overlap tends to occur when one or more organisms obtain food from a particular source using the following formula (Tresna, et al., 2012).

$$Ch = \frac{2\sum Pij.Pik}{\sum Pij^2 + Pik^2}$$

141
142
143
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C_H = Morisita Index

P_{ij} , P_{ik} = Proportion of species of i-th food organism used by two groups of j-th fish and k-th fish groups, in the same population

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Trophic Level of an organism

The trophic level of an organism is determined by counting the food fraction, which is obtained by the number of individuals per organism divided by the total number of individuals found in a particular group of fish with similar sizes. The trophic level is calculated with the following formula

$$Troph_i = 1 + \sum DC_{ij} \times Troph_j$$

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Troph-i = Trophic level i-th fish

DC_{ij} = j-th food fraction eaten by i

Troph-j = Trophic level fraction of j-th food

Based on the analysis, the trophic level is categorized into

2,00 < Troph < 2,9 category II fish as herbivore

2,9 < Troph < 3,7 category III fish as carnivore

3,7 < Troph < 4,5 category IV fish as carnivore

159

RESULTS AND DISCUSSION

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Relative Length of Gut of *Pterygoplichthys pardalis* from Ciliwung river

The results from the analysis of the relative length of gut (RLG) showed that the *Pterygoplichthys pardalis* found in the Ciliwung River is included in the category of herbivorous fish. This is observed in the RLG values for each group of fish. The RLG from large to small fish groups are 10,98 cm, 11,17 cm, and 17,49 cm, respectively. Based on these values, *Pterygoplichthys pardalis* is included in the category of RLG > 3, as shown in Table 1.

Table 1: Relative Length of Gut in each fish category

Fish Categories	Total Length (TL)	Gut Length (GL)	RLG (cm)
Large fish	37,03	406,75	10,98
Medium fish	31,73	354,6	11,17
Small fish	21,64	378,53	17,49

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The relative length of the gut is used as an indicator of the fish's feeding habits by comparing its length to the total length (Fariedah, et al., 2017); (Delariva & Agostinho, 2001). According to a research conducted by Tisasari, fish classified as herbivores usually have a total gut length of 5,9 times the body length (Tisasari, et al., 2016). Gut length is influenced by the fish's feeding patterns, which is observed in the relationship between the diet type and the gut length. *Rhinelepis aspera* has a significantly different gut length from *Megalancistrus aculeatus* because it has an entirely different diet type, however, both are species of *Loricariidae* (Delariva & Agostinho, 2001).

174 *Pterygoplichthys pardalis* has a relatively long gut and is classified as herbivore however, and digestion lasts longer
 175 compared to fish in the other groups. The structure of the gut shows a strong adaptation to any diet type. Plecos fish diet
 176 type includes plant fragments, algae, and detritus. Algae and detritus are hard to digest and require longer mechanical
 177 power. The digestive process requires a large area for absorption, and this causes elongates the gut of the pleco (Samat, et
 178 al., 2016).

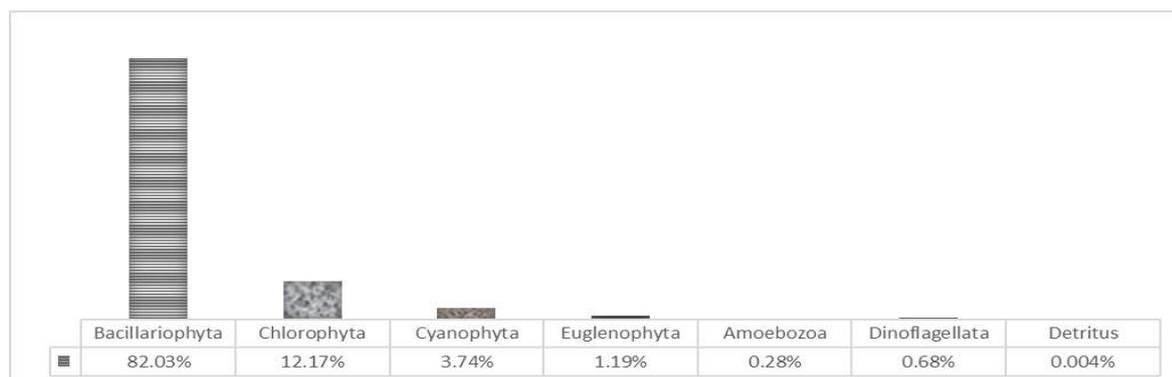
179 ***Pterygoplichthys pardalis* Gut content in Ciliwung river**

180 The results from the analysis of the gut content of *Pterygoplichthys pardalis* in the Ciliwung river showed that the
 181 various types of natural fish diet are grouped into *Bacillariophyta*, *Chlorophyta*, *Cyanophyta*, *Euglenophyta*, *Amoebzoa*,
 182 *Dinoflagellata*, and detritus as shown in table 2. *Bacillariophyta* is commonly found in the guts of plecos fish compared to
 183 the others. Conversely, these groups were discovered in as many as 59 genera. Generally, the *Bacillariophyta* group is
 184 found in sediments and substrates of both mild and strong currents (Harmoko, 2018); (Genkal & Yarushina, 2016); (Buck
 185 & Sazima, 1995). This is consistent with the feeding behavior of *Pterygoplichthys pardalis* as a bottom feeder fish,
 186 because this group is a type of phytoplankton that is widely attached to sediments or substrates (Genkal & Yarushina,
 187 2016) (Genkal & Yarushina, 2014); (Buck & Sazima, 1995). The type of diet consumed by *Pterygoplichthys pardalis*
 188 determines the feeding habits in the Ciliwung river.

189 Table 2. The composition of the *Pterygoplichthys pardalis* natural diets in the Ciliwung river in accordance with gut
 190 content analysis
 191

Category	Type
Bacillariophyta	Achnanthes sp., Achnantidium sp., Amphipleura sp., Amphora sp., Aneumastus sp., Aulacoseira sp., Bacillaria sp., Caloneis sp., Climacosphenia sp., Cocconeis sp., Craticula sp., Cyclotella sp., Cymbella sp., Cymbopleura sp., Diademsis sp., Diatoma sp., Diploneis sp., Encyonema sp., Entophysalis sp., Encyonopsis sp., Eolimna sp., Eunotia sp., Ephitemia sp., Fallacia sp., Fragilaria sp., Frustulia sp., Geissleria sp., Gomphoneis sp., Gomphonema sp., Grammatophora sp., Gyrosigma sp., Halamphora sp., Hantzschia sp., Luticola sp., Lemnicola sp., Lyrella sp., Mastogloia sp., Melosira sp., Navicula sp., Neidium sp., Nepula sp., Nitzschia sp., Oedogonium sp., Pinnularia sp., Placoneis sp., Planothidium sp., Prestauroneis sp., Rhoicospenia sp., Rivularia sp., Rhopalodia sp., sellaphora sp., Stauroneis sp., Stenopterobia sp., Stephanodiscus sp., Surirella sp., Synedra sp., Tabularia sp., Tryblionella sp., Ulnaria sp.
Chlorophyta	Ankistrodesmus sp., Asterococcus sp., Bulbochaete sp., Chlamydomonas sp., Chlorella sp., Chlorococcum sp., Chlorococcus sp., Closterium sp., Choricystis sp., Coleastrum sp., Cosmarium sp., Crucigenia sp., Desmodesmus serratus, Dictyochloropsis sp., Dictyococcus sp., Dictyosphaerium sp., Eudorina sp., Haematococcus sp., Microspora sp., Monoraphidium sp., Oocystis sp., Oophila sp., Palmellopsis sp., Pediastrum sp., Planktosphaeria sp., Scenedesmus sp., Selenastrum sp., Staurastrum sp., Steogclomium sp., Tetrastrum sp., Tetraedron sp., Tetraspora sp., Volvox sp., Zygnema sp.
Cyanophyta	Anabaena sp., Aphanizomenon sp., Aphanocapsa sp., Aphanothece sp., Arthrospira sp., Chlorogloea sp., Chroococcus sp., Gloeocapsa sp., Gleocapsopsis sp., Gloeocystis sp., Gloeotheca sp., Gloeothichia sp., Merismopedia sp., Neosporangiococcus sp., Nostoc sp., Phormidium sp., Pseudocapsa sp., Pseudonabaena sp., Rivularia sp., Synechococcus sp., Tychonema sp.,
Euglenophyta	Euglena sp., Lepocinclis sp., Phacus sp., Trachelomonas sp., Wailesella sp.
Amoebzoa	Arcella sp., Centropyxis sp., Clypeolina sp., Pyxidicula sp.,
Dinoflagellata	Prorocentrum sp.
Detritus	Meliola sp., Pestalotiopsis sp.

192
 193 The results from the gut content analysis, showed that the calculated percentage of natural diet consumed by
 194 *Pterygoplichthys pardalis* is 82.03% *Bacillariophyta*. Therefore, it is the commonest type of natural diet, with
 195 *Chlorophyta*, *Cyanophyta*, *Euglenophyta*, *Amoebzoa*, *Dinoflagellata*, and detritus at 12.17%, 3.74%, 1.19%, 0.28%,
 196 0.68%, and 0%, respectively as shown in Figure
 197



199 Figure 2: Percentage of *Pterygoplichthys pardalis* natural diet in the Ciliwung River based on gut content analysis
200

201 *Bacillariophyta* is used as the primary source of the natural diet for the *Pterygoplichthys pardalis* in the Ciliwung river
202 because its habitat is at the bottom of the water, and it supports the characteristics of the mouth shape of plecos fish.
203 According to the results from the study conducted by Pambudi in 2015, *Bacillariophyta* had the highest abundance
204 compared to other divisions found in the river, followed by *Chlorophyta* (Pambudi, et al., 2016).

205 Plecos consumes phytoplankton, zooplankton and detritus as its main (56.39%), supplementary (36.94%) and
206 additional (6.67%) diets. These results are similar to those obtained in the research conducted by Tisasari which stated that
207 pleco's main diet are *Bacillariophyta*, *Chlorophyta* and *Cyanophyta* serve as supplementary foods, while *Eugleophyta*,
208 *Xanthophyta*, *Crustacea* are additional diet (Manna, et al., 2020); (Tisasari, et al., 2016); (de Oliveira & Isaac, 2013). The
209 dissimilarities in the feeding habits of fishes tend to occur as a result of the differences in the availability of food utilized in
210 its natural habitat. According to Effendi, fish's preference for diet is relative. Additionally, the distribution of food
211 organisms, availability of natural diet, and physical conditions tend to influence their feeding habits (Effendie, 1997).
212 Therefore, greater availability of food resources in the invaded habitats provided conditions that are conducive for the
213 establishment of non-native species (Garcia, et al., 2018); (Delariva & Agostinho, 2001).

214 ***Pterygoplichthys pardalis* Index Preponderance in Ciliwung river**

215 Index Preponderance (IP) explains the natural diet preferences of *Pterygoplichthys pardalis*. Subsequently, IP based
216 on the different types of fish groups shows similar diet preferences. The three groups of *Pterygoplichthys pardalis* utilizes
217 *Bacillariophyta* as its main natural food. The IP values of *Bacillariophyta* in the large, medium and small fish groups are
218 86.70%, 78.66%, and 81.11%, respectively, as shown in figure 1. The preference of *Bacillariophyta* as the main natural
219 diet for *Pterygoplichthys pardalis* shows that its availability in the river is quite abundant. In addition, it is a type of
220 microalgae that is epilithic, thereby making it is suitable for *Pterygoplychthys pardalis*. Morphologically, *Pterygoplichthys*
221 *pardalis* has a triangular mouth shape suited towards the ventral that supports its feeding habits. This is due to the fact that
222 it belongs to the group of algae-feeding fish that covers the bottom surface of the water. The morphology of the mouth's
223 shape and structure allows the fish to erode food from hard surfaces and swallow soft sediments efficiently (Samat, et al.,
224 2016).

225 The IP value of *Chlorophyta* in the large, medium, and small fish groups are 6.87%, 17.27%, and 12.40%, respectively.
226 Conversely, the IP value of *Cyanophyta* in the large, medium, and small fish groups are 5.24%, 1.87%, and 4.11%, as
227 shown in figure 3. This showed that they are a type of natural supplementary diet for *Pterygoplichthys pardalis* in the
228 Ciliwung river. The abundance of *Cyanophyta* in the river ranks third after *Bacillariophyta* and *Chlorophyta* (Pambudi, et
229 al., 2016). This statement is supported by the results from the research which stated that *Chlorophyta* and *Cyanophyta*
230 discovered in the guts of plecos fish in the Langat River, are relatively abundant in the habitat (Samat, et al., 2016).
231 According to Sulistiono, fishes generally adjust the food types to the size of their mouth openings, while the larger ones
232 tend to consume more food (Sulistiono, et al., 2009).

233 The IP analysis obtained, showed that *Pterygoplichthys pardalis* is included in the opportunist fish group because it is
234 able to utilize the food available in the river. Plecos fish consumes phytoplankton as its main food (56.39%), while
235 zooplankton serves its supplementary food (36.94%) and detritus as the additional food (6.67%) (Tresna, et al., 2012).
236 However, *Pterygoplichthys pardalis* consumes *Bacillariophyta* as its main food, *Chlorophyta* and *Cyanophyta*, as its
237 supplementary foods, while *Euglenophyta*, *Xanthophyta*, *Crustacea* serves as additional foods (Manna, et al., 2020);
238 (Mazzoni, et al., 2010); (Tisasari, et al., 2016). The differences in feeding habits of a particular type of fish tend to occur
239 due to dissimilarities in the availability of food utilized in its natural habitat. Distribution of diet organisms, availability of
240 food in the habitat, species of fish, and physical conditions influences feeding habits (Sofarini, et al., 2019); (de Oliveira
241 & Isaac, 2013); (Effendie, 1997). It is also influenced by competition between individuals, predators, food chains from
242 broad areas, and overlapping food niches (Manna, et al., 2020); (Effendi, 2003).
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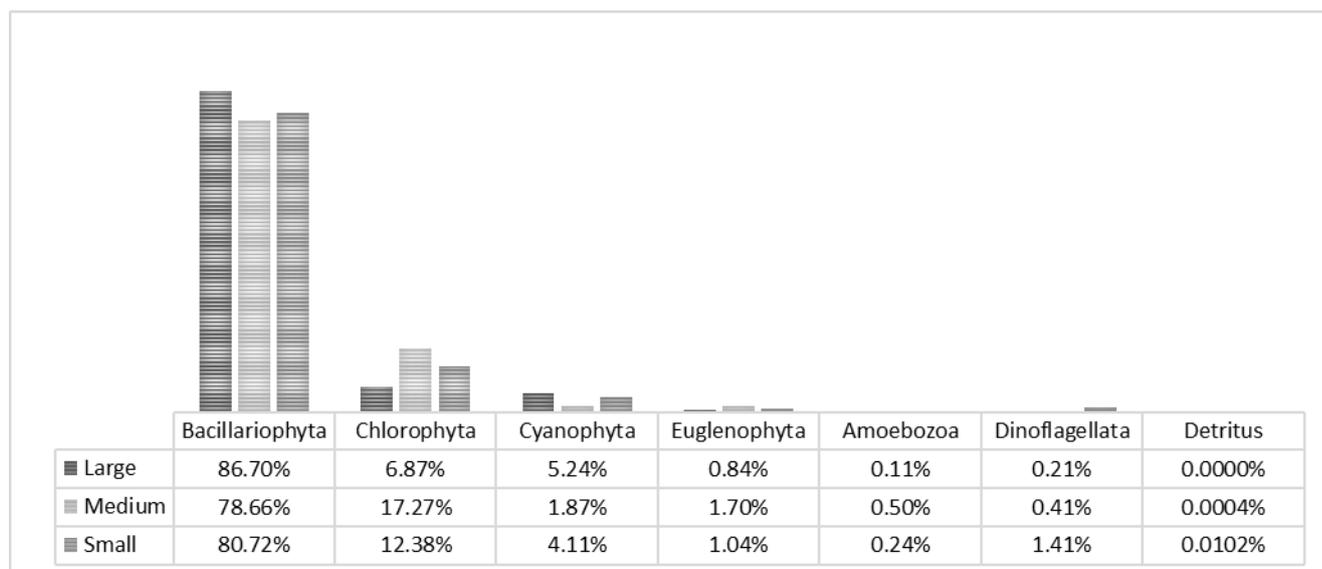


Figure 3. Index Preponderance of natural diet in each group of *Pterygoplichthys pardalis* in the Ciliwung River

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246 Feeding Niches Area

247 The feeding niches area is a description of the proportion of the various food consumed by a particular type of fish
248 (Giller, 1984). The area of the feeding niche showed the size of the fish group that utilizes the available organisms as its
249 natural diet source, in addition, it also utilizes aquatic resources (de Oliveira & Isaac, 2013); (Sulistiono, et al., 2009).
250 Analysis of the feeding niche area is determined by the number and size of the different types of individuals in each group.
251 Standardization is conducted to obtain a broad variety of niches ranging from 0-1 intervals between variables that are not
252 similar (Izzani, 2012).

253 The results from the analysis of *Pterygoplichthys pardalis* feeding niche area in the Ciliwung river in accordance with
254 the group differences showed that the large fish group has a larger niche area 42,87 compared to the other groups with
255 standardization of 0.22 (table 3). The huge value is expected because the fish are able to utilize the resources available in
256 large quantities. However, this value is influenced by the number of the different types of food consumed by a particular
257 group of fish with a relatively large niche area tends to have an increased number of species that are utilized as their food
258 sources (Tresna, et al., 2012). It also implies that the fish group tends to evenly utilize all available resources in the aquatic
259 environment as their natural diet (Elinah, et al., 2016). Besides, the size of the fish also affects the external diet niche. The
260 feeding niche area for fishes is influenced by its length and size in their habitats (Hedianto, et al., 2010).

261
262

Table 3. The area of niches and standardisation in each size category

Category	Size	Niche Area	Standardization
Large fish	340 - 415 mm	42.87	0.22
Medium fish	264 - 339 mm	36.01	0.19
Small fish	187 - 263 mm	16.78	0.07

263
264

The medium size fish group has a niche value of 36.01 with a standardization of 0.19 (table 3). This value is lower than
265 that of the large fish group, and its decrease is due to the differences in the utilization of diet resources in the river.
266 Therefore, fish with a lower niche area means that its group tends to be more selective in utilizing resources (Hedianto, et
267 al., 2010).

268 The small size fish group has a lower niche area value of 16.78 with 0,07 standardization as shown in table 3, because
269 it uses food selectively. Fish that have a relatively small niche area uses less food types, and they specialize in utilizing
270 diet resources (Sentosa & Satria, 2015).

271 The joint use of available diet resources by the fish size groups tends to cause overlapping niches (Sentosa & Satria,
272 2015). Overlapping occurs when the food resources are shared by two or more types of fish (Krismono, et al., 2008)

273 The results from the analysis of overlapping niches showed that the relationship between the large and medium fish
274 groups has a greater value (0.77) compared to that of other groups (table 4). The value of overlapping niches implies the
275 presence of organisms that are shared between the groups. It also showed the similarity in resource utilization of 0.77.
276 High overlapping values cause large and medium fish groups to compete for food.

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278

Table 4. The intraspecific overlapping value between fish groups

Category	Large	Medium	Small
Large		0.77	0.42
Medium			0.43
Small			

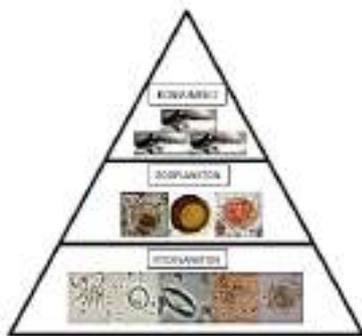
279 The overlapping relationship between large and small fish groups is 0.42, and that of the medium and small fish groups
 280 have a similarity value of 0.43 (table 4). This means that the overlapping relationship between the medium and small
 281 groups, large and small groups, is lower compared to that between large and medium groups. The low value showed that
 282 there are differences in the organisms used. In addition, it is suspected that this reason led to a huge increase in the number
 283 of small and medium fish that was simultaneously discovered in the Kalibata area.

284 The value of overlapping feeding niches is approximately one (1). This means that similar resources are used which
 285 caused the 2 groups of fish to be highly competitive between two groups of fish. Overlapping values that are
 286 approximately zero (0) showed the differences in diet types between the two groups (Krismono, et al., 2008).
 287 Furthermore, overlapping of niches tends to occur when there are similarities in the diet types that are shared by two or
 288 more groups of fish (de Oliveira & Isaac, 2013); (Izzani, 2012). The overlapping values of each group tend to trigger
 289 interactions or compete for food in the same location (de Oliveira & Isaac, 2013); (Krismono, et al., 2008).
 290

291 *Pterygoplichthys pardalis* trophic level in the Ciliwung River

292 The results from the analysis of the trophic level of *Pterygoplichthys pardalis* in the Ciliwung River showed no
 293 difference in each of the groups. The value of *Pterygoplichthys pardalis* trophic level in the river is 2.00, which means that
 294 it is classified as group II herbivorous fish. This is in accordance with the trophic level category values ($2.00 < \text{troph} < 2.90$).
 295 Herbivorous fish belong to group II because they eat phytoplankton, which is a type of food fraction at the trophic
 296 level of group I (figure 3). Fish species classified as herbivores consume plants, phytoplankton, and detritus (Hedianto et
 297 al. 2010). The analysis of trophic level supports Samat's statement that plecos fish have long guts and belong to the
 298 herbivorous group that feeds on algae and detritus (Samat, et al., 2016) besides, the environmental conditions are
 299 important for diet composition (Manna, et al., 2020).

300 *Pterygoplichthys pardalis* is classified as a level I consumer and belongs to the herbivorous group, however, this
 301 causes it to compete with native fish for food. According to Tresna, Wader (*Mystacoleucus marginatus*) and silver rasbora
 302 (*Rasbora argyrotaenia*) are native fish from Cimanuk river, Garut subsequently, the composition of their natural diet
 303 consist of plankton, plant fragments, and detritus (Tresna et al. 2012). Native fish tend to compete with *Pterygoplichthys*
 304 *pardalis* due to the composition of a natural diet in the feeding habitat. The ability of fish to adapt to environmental
 305 conditions is a determinant of its adaptation in the river (Sofarini, et al., 2019). *Pterygoplichthys pardalis* is able to
 306 survive in a polluted aquatic environment, however, it is also supported by morphological characters, such as an
 307 additional respiratory organ that functions as a respirator in poorly dissolved oxygen conditions (Moroni, 2015). These
 308 fish possess hard and prickly scales therefore there are no predators in the waters (Hadiaty, 2011). The migration of
 309 *Pterygoplichthys pardalis* in the waters of the Ciliwung river disrupted the food chain due to their feeding habits because
 310 they tend to feed on benthic algae and compete with native fish (Rao, 2017).



311 Figure 3. The trophic level of plecos fish in Ciliwung River.

312
 313
 314 In conclusion, the *Pterygoplichthys pardalis* belongs to the group II ($2.00 < \text{trophies} < 2.90$) trophic level and is
 315 classified as a herbivorous fish in the ecosystem of the Ciliwung river. The composition of its natural diet consists of
 316 *Bacillariophyta*, *Chlorophyta*, *Cyanophyta*, *Euglenophyta*, *Dinoflagellata*, *Amoebozoa*, and detritus in the riverbed with
 317 *Bacillariophyta* as its main natural diet at a preference value of 82.03% (IP > 40%). Meanwhile, its supplementary diet
 318 consist of 12.17% (IP 4-40%) of *Chlorophyta* and additional diet (IP < 40%) of *Cyanophyta* (3.74%), *Euglenophyta*
 319 (1.19%), *Amoebozoa* (0.28%), *Dinoflagellata* (0.68%) and detritus 0.00%.

320

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SUBMISSION CHECKLIST

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<ul style="list-style-type: none">Phone and facsimile numbers (incl country phone code)	X

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[biodiv] Submission Acknowledgement

From : Ahmad Dwi Setyawan <smujo.id@gmail.com>

Jum, Apr 03, 2020 07:59 PM

Subject : [biodiv] Submission Acknowledgement**To :** Dewi Elfidasari <d_elfidasari@uai.ac.id>**Reply To :** Ahmad Dwi Setyawan <editors@smujo.id>

Dewi Elfidasari:

Thank you for submitting the manuscript, "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis" to Biodiversitas Journal of Biological Diversity. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Submission URL: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Username: elfidasaridewi

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Ahmad Dwi Setyawan

[Biodiversitas Journal of Biological Diversity](#)

[biodiv] New notification from Biodiversitas Journal of Biological Diversity

From : Deka <smujo.id@gmail.com>

Kam, Apr 09, 2020 03:54 PM

Subject : [biodiv] New notification from Biodiversitas Journal of Biological Diversity**To :** Dewi Elfidasari <d_elfidasari@uai.ac.id>**Reply To :** Deka <sectioneditor5@smujo.id>, Ahmad Dwi Setyawan <editors@smujo.id>

You have a new notification from Biodiversitas Journal of Biological Diversity:

You have been added to a discussion titled "Pre-Review" regarding the submission "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

Link: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Ahmad Dwi Setyawan

[Biodiversitas Journal of Biological Diversity](#)

Re: [biodiv] New notification from Biodiversitas Journal of Biological Diversity

From : Dewi Elfidasari <d_elfidasari@uai.ac.id>
Subject : Re: [biodiv] New notification from Biodiversitas
Journal of Biological Diversity
To : Deka <sectioneditor5@smujo.id>, Ahmad Dwi
Setyawan <editors@smujo.id>

Jum, Apr 17, 2020 09:00 AM

Dear Biodiversitas Editor

I have submitted the revised manuscript according to the advice of the reviewer regarding the manuscript references

Thank you

From: "Deka" <smujo.id@gmail.com>
To: "Dewi Elfidasari" <d_elfidasari@uai.ac.id>
Sent: Thursday, April 9, 2020 3:54:55 PM
Subject: [biodiv] New notification from Biodiversitas Journal of Biological Diversity

You have a new notification from Biodiversitas Journal of Biological Diversity:

You have been added to a discussion titled "Pre-Review" regarding the submission "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

Link: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Ahmad Dwi Setyawan

[Biodiversitas Journal of Biological Diversity](#)

[biodiv] New notification from Biodiversitas Journal of Biological Diversity

From : Smujo Editors <smujo.id@gmail.com>

Sen, Apr 27, 2020 09:55 AM

Subject : [biodiv] New notification from Biodiversitas Journal of Biological Diversity

To : Dewi Elfidasari <d_elfidasari@uai.ac.id>

Reply To : Smujo Editors <editors@smujo.id>

You have a new notification from Biodiversitas Journal of Biological Diversity:

There is new activity in the discussion titled "Pre-Review" regarding the submission "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

Link: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Ahmad Dwi Setyawan

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[biodiv] Editor Decision

From : Smujo Editors <smujo.id@gmail.com>

Rab, Mei 27, 2020 05:38 PM

Subject : [biodiv] Editor Decision**To :** Dewi Elfidasari <d_elfidasari@uai.ac.id>, Fahma
Wijayanti <fahma.wiyaja@yahoo.com>, Afifah
<afifatussolihah08@gmail.com> 1 attachment **Reply To :** Smujo Editors <editors@smujo.id>

Dewi Elfidasari, Fahma Wijayanti, Afifah:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

Our decision is: Revisions Required

Smujo Editors
editors@smujo.id-----
Reviewer A:

The manuscript is of good scientific quality. There is just some comments put in the text.

Recommendation: Accept Submission

[Biodiversitas Journal of Biological Diversity](#)

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975 KB

[biodiv] New notification from Biodiversitas Journal of Biological Diversity

From : Smujo Editors <smujo.id@gmail.com>

Min, Mei 31, 2020 08:54 PM

Subject : [biodiv] New notification from Biodiversitas Journal of Biological Diversity

To : Dewi Elfidasari <d_elfidasari@uai.ac.id>

Reply To : Smujo Editors <editors@smujo.id>

You have a new notification from Biodiversitas Journal of Biological Diversity:

You have been added to a discussion titled "Uncorrected Proof" regarding the submission "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

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Ahmad Dwi Setyawan

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[biodiv] New notification from Biodiversitas Journal of Biological Diversity

From : DEWI NUR PRATIWI <smujo.id@gmail.com>

Sen, Jun 01, 2020 05:39 AM

Subject : [biodiv] New notification from Biodiversitas Journal
of Biological Diversity

To : Dewi Elfidasari <d_elfidasari@uai.ac.id>

Reply To : DEWI NUR PRATIWI <biodiv07@gmail.com>,
Ahmad Dwi Setyawan <editors@smujo.id>

You have a new notification from Biodiversitas Journal of Biological Diversity:

You have been added to a discussion titled "BILLING" regarding the submission "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

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Ahmad Dwi Setyawan

[Biodiversitas Journal of Biological Diversity](#)

[biodiv] Editor Decision

From : Smujo Editors <smujo.id@gmail.com>

Sel, Jun 02, 2020 12:37 PM

Subject : [biodiv] Editor Decision

To : DEWI ELFIDASARI <d_elfidasari@uai.ac.id>, FAHMA
WIJAYANTI <fahma.wiyaja@yahoo.com>, AFIFATUS
SHOLIAH <afifatssholihah08@gmail.com>

Reply To : Smujo Editors <editors@smujo.id>

DEWI ELFIDASARI, FAHMA WIJAYANTI, AFIFATUS SHOLIAH:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "Trophic level and position of Pterygoplichthys pardalis in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis".

Our decision is to: Accept Submission

Smujo Editors
editors@smujo.id

[Biodiversitas Journal of Biological Diversity](#)

[biodiv] Editor Decision

From : Smujo Editors <smujo.id@gmail.com>

Sel, Jun 02, 2020 12:39 PM

Subject : [biodiv] Editor Decision**To :** DEWI ELFIDASARI <d_elfidasari@uai.ac.id>, FAHMA
WIJAYANTI <fahma.wiyaja@yahoo.com>, AFIFATUS
SHOLIAH <afifatssholihah08@gmail.com>**Reply To :** Smujo Editors <editors@smujo.id>

DEWI ELFIDASARI, FAHMA WIJAYANTI, AFIFATUS SHOLIAH:

The editing of your submission, "Trophic level and position of *Pterygoplichthys pardalis* in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis," is complete. We are now sending it to production.

Submission URL: <https://smujo.id/biodiv/authorDashboard/submission/5754>Smujo Editors
editors@smujo.id

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5754 / **Elfidasari et al.** / Trophic level and position of Pt...

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▶ Comments for the Editor	elfidasaridewi 2020-04-03 12:15 PM	elfidasaridewi 2020-04-17 01:47 AM	1	<input type="checkbox"/>
Pre-Review	deka 2020-04-09 08:54 AM	elfidasaridewi 2020-04-27 11:58 PM	3	<input type="checkbox"/>

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workflow by
OJS / PKP



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Dewi Elfidasari (elfidasaridewi)

Messages

Note	From
<p>Dear Editor of Biodiversitas Journal</p> <p>Hereby I send the manuscript of my research article for published in this journal</p> <p>This article is the result of our research that has been funding by The Ministry of Research and Technology, Higher Education in 2018. The novelty of this study is the result of research that explains the trophic level and position of <i>Pterygoplichthys pardalis</i> in Ciliwung river. It's explains something new that has never been found in another research with the object <i>Pterygoplichthys pardalis</i> in Ciliwung river Indonesia.</p> <p>I hope that this manuscript can be published in this journal.</p> <p>Thank you</p> <p>Sincerely</p>	<p>elfidasaridewi 2020-04-03 12:15 PM</p>
<p>▶ Dear Editor of Biodiversitas Journal</p> <p>Hereby I submit the revised manuscript according to the advice of the reviewer regarding the manuscript references</p> <p>Sincerely</p> <p> elfidasaridewi, Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem_DewiElfidasari_Rev_References.doc</p>	<p>elfidasaridewi 2020-04-17 01:47 AM</p>

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Participants [Edit](#)

Dewi Elfidasari (elfidasaridewi)

Messages

Note	From
<p>Dear Editor of Biodiversitas Journal</p> <p>Hereby I send the manuscript of my research article for published in this journal</p> <p>This article is the result of our research that has been funding by The Ministry of Research and Technology, Higher Education in 2018. The novelty of this study is the result of research that explains the trophic level and position of <i>Pterygoplichthys pardalis</i> in Ciliwung river. It's explains something new that has never been found in another research with the object <i>Pterygoplichthys pardalis</i> in Ciliwung river Indonesia.</p> <p>I hope that this manuscript can be published in this journal.</p> <p>Thank you</p> <p>Sincerely</p>	<p>elfidasaridewi 2020-04-03 12:15 PM</p>
<p>▶ Dear Editor of Biodiversitas Journal</p> <p>Hereby I submit the revised manuscript according to the advice of the reviewer regarding the manuscript references</p> <p>Sincerely</p> <p> elfidasaridewi, Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem_DewiElfidasari_Rev_References.doc</p>	<p>elfidasaridewi 2020-04-17 01:47 AM</p>

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Participants

Dewi Elfidasari (elfidasaridewi)

Deka (deka)

Messages

Note	From
Thankyou for your submission. Unfortunately, I have some correction for your mss. At least you need to compose 20 citation which : 1) 80% of international scientific journals published in the last 10 years. 2) only 10% national scientific journal in the mss.	deka 2020-04-09 08:54 AM
▶ Thank you for this advice, I'll improve according to the advice given	elfidasaridewi 2020-04-11 11:53 AM
Kindly inform us your improved mss.	editors 2020-04-27 02:55 AM
▶ hereby I send the revised manuscript Sincerely Dewi  elfidasaridewi, Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem_DewiElfidasari_Rev_References.doc	elfidasaridewi 2020-04-27 11:58 PM

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Participants

Dewi Elfidasari (elfidasaridewi)

Deka (deka)

Messages

Note	From
Thankyou for your submission. Unfortunately, I have some correction for your mss. At least you need to compose 20 citation which : 1) 80% of international scientific journals published in the last 10 years. 2) only 10% national scientific journal in the mss.	deka 2020-04-09 08:54 AM
▶ Thank you for this advice, I'll improve according to the advice given	elfidasaridewi 2020-04-11 11:53 AM
Kindly inform us your improved mss.	editors 2020-04-27 02:55 AM
▶ hereby I send the revised manuscript Sincerely Dewi  elfidasaridewi, Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem_DewiElfidasari_Rev_References.doc	elfidasaridewi 2020-04-27 11:58 PM

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Round 1 Status

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Notifications

[biodiv] Editor Decision	2020-05-27 10:38 AM
[biodiv] Editor Decision	2020-06-02 05:37 AM
[biodiv] Editor Decision	2020-06-02 05:39 AM

Reviewer's Attachments

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Review Discussions

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Uncorrected Proof	editors 2020-05-31 01:54 PM	-	0	<input type="checkbox"/>
BILLING	dewinurpratiwi 2020-05-31 10:37 PM	-	0	<input type="checkbox"/>
▶ 5754-Article Text-23634-1-18-20200531 revised	elfidasaridewi 2020-06-01 11:24 AM	-	0	<input type="checkbox"/>
▶ Payment of fee publication	elfidasaridewi 2020-06-01 11:40 AM	-	0	<input type="checkbox"/>



[biodiv] Editor Decision

2020-05-27 10:38 AM

Dewi Elfidasari, Fahma Wijayanti, Afifah:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "Trophic level and Position of Pterygoplichthys pardalis in Ciliwung River ecosystem based on the gut content analysis".

Our decision is: Revisions Required

Smujo Editors
editors@smujo.id

Reviewer A:

The manuscript is of good scientific quality. There is just some comments put in the text.

Recommendation: Accept Submission

[Biodiversitas Journal of Biological Diversity.](#)



[biodiv] Editor Decision

2020-05-27 10:38 AM

Dewi Elfidasari, Fahma Wijayanti, Afifah:

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[Biodiversitas Journal of Biological Diversity.](#)



[biodiv] Editor Decision

2020-06-02 05:37 AM

DEWI ELFIDASARI, FAHMA WIJAYANTI, AFIFATUS SHOLIAH:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "Trophic level and position of *Pterygoplichthys pardalis* in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis".

Our decision is to: Accept Submission

Smujo Editors
editors@smujo.id

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[biodiv] Editor Decision

2020-06-02 05:37 AM

DEWI ELFIDASARI, FAHMA WIJAYANTI, AFIFATUS SHOLIAH:

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Smujo Editors
editors@smujo.id

[Biodiversitas Journal of Biological Diversity](#)



[biodiv] Editor Decision

2020-06-02 05:39 AM

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The editing of your submission, "Trophic level and position of *Pterygoplichthys pardalis* in Ciliwung River (Jakarta, Indonesia) ecosystem based on the gut content analysis," is complete. We are now sending it to production.

Submission URL: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Smujo Editors
editors@smujo.id

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[biodiv] Editor Decision

2020-06-02 05:39 AM

DEWI ELFIDASARI, FAHMA WIJAYANTI, AFIFATUS SHOLIAH:

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Submission URL: <https://smujo.id/biodiv/authorDashboard/submission/5754>

Smujo Editors
editors@smujo.id

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Participants

Smujo Editors (editors)

Dewi Elfidasari (elfidasaridewi)

DEWI NUR PRATIWI (dewinurpratiwi)

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Participants

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Dewi Elfidasari (elfidasaridewi)

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Smujo Editors (editors)

Dewi Elfidasari (elfidasaridewi)

Deka (deka)

Messages

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Dear Journal Editor I send the following revised article according to the editor advice Thank you Sincerely Dewi  elfidasaridewi, 5754-Article Text-23634-1-18-20200531_revised.doc	elfidasaridewi 2020-06-01 11:24 AM

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Participants [Edit](#)

Smujo Editors (editors)

Dewi Elfidasari (elfidasaridewi)

Deka (deka)

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Participants

Dewi Elfidasari (elfidasaridewi)

DEWI NUR PRATIWI (dewinurpratiwi)

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Participants

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DEWI NUR PRATIWI (dewinurpratiwi)

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DEWI NUR PRATIWI (dewinurpratiwi)

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Dewi Elfidasari (elfidasaridewi)

DEWI NUR PRATIWI (dewinurpratiwi)

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