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Determination of Condition Factor (CF) and Hepatosomatic Index (HSI) of *Barbonymus schwanenfeldii* from Galas River, Kelantan

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Abstract

The rapid growth of agriculture and industrial activities has resulted in decreasing of water quality in the aquatic ecosystem, which is significantly hazardous for fish health. Fish are commonly situated at the top of aquatic food chain is known to be nutritious with essential proteins. The purpose of this study is to determine the condition factor and hepatosomatic index of *Barbonymus schwanenfeldii* from Galas River, Kelantan. The sizes of slaughtered fish ranging from 319 ± 0.05 to 456 ± 1.32 g in weight while 28 ± 0.34 to 36 ± 1.42 cm in total length. From a sample size of 40 specimens, the average of K value was 1.15 ± 0.21 and 2.31 ± 0.13 of HSI value. Thus, the results revealed that the fish species was in a poor condition. Refer to the matter; the condition of study area is not suitable for fish habitat. Condition factor of fishes is important biological parameter which can provides information on fish well-being. The condition factor and hepatosomatic index compares the well-being of a fish is based on the hypothesis that heavier fish of a given length are in a better condition.

1. Introduction

Generally, knowledge of quantitative aspects such as condition factor and hepatosomatic index is important in studying fish biology and health. Fish can achieve either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is linked with no change of body shape as an organism grows. Negative allometric growth associated with the fish become skinny as it increase in weight while positive allometric growth implies the fish becomes plump as it increases in length. Exposure of fishes to contaminants can alter their important energetic and biochemical pathways with various deleterious consequences (Adeogun et al., 2015). This pollutant exists in the aquatic ecosystem deriving from both natural and anthropogenic sources (Asmah & Biney, 2014).

The condition factor (CF) is defined as the well-being of fish in their habitat and expressed by 'coefficient of condition'. Usually, this factor measures several of ecological and biological factors such as degree of fitness, gonad development and the suitability of the environment with concern to the feeding condition. In addition, condition factor also can be used as in index to assess the status of the aquatic ecosystem (Manorama & Ramanujam, 2014). Meanwhile, hepatosomatic index (HSI) is defined as ratio of liver weight to body weight and usually used in fisheries research as an indicator of energy reserve in the liver (Kumari et al., 2014; Cerda et al., 1996). This index can provide information on potential pollution impacts which can be used for conservation and management of fish population (Jelodar et al., 2012). A fish body condition is practical tool for biologists to measure the overall health of fish population, and a good indicator of fish habitat quality and pollution levels (Craig et al., 2005).

Barbonymus schwanenfeldii is a ray-finned fish genus, which is classified under the family of Cyprinidae and order of Cypriniformes (Mansor et al., 2012). This species is enormously distributed throughout Southeast Asia including the countries Cambodia, Laos, Thailand, Vietnam, Singapore, Indonesia, Brunei and Malaysia. This species spends most of their time between the bottom and the mid-level of the waterways and known as fast breeding fish which is three times per year (Gante et al., 2008). The aim of the present study is to determine the condition factor and hepatosomatic index of *Barbonymus schwanenfeldii* which linked to fish habitat quality.

2. Materials and Methods

The study was carried out at Sungai Galas, Kelantan at coordinate N5°21'45.9"E102°0'20.8944". Sungai Galas is one of the channel rivers of the Sungai Kelantan which is performed by the junction of Sungai

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Neggiri and Sungai Pergau. The river has a catchment area of about 3,970 km^2 and 7,770 km^2 of total area (Baharoma & Ishak, 2015), which serves as a source of raw water supplies to the community and fulfil the needs of nearby agricultural activities (Rohasliney et al., 2015).

Field study and sampling were conducted during July until September 2016. The basic parameters, temperature, conductivity, total dissolved solid (TDS), salinity, dissolved oxygen (DO), and pH, were indicated in situ using YSI portable multi probes (YSI incorporated, Yellow Spring®, Ohio, USA), while portable Turbidimeter Hanna Model 2100P was used to measured turbidity. For the water sampling, high-density polyethylene sampling bottle were rinsed twice with the water sample before collection. The closed sampler was submersed and then the bottle was opened in the water to fill in and recapped in the sub-surface (USEPA, 1999). The samples were stored under 8°C for further analysis.

The *Barbonymus schwanenfeldii* were donated by local fishermen, which were wild caught from Sungai Galas. The specimens were wrapped individually in polyethylene sampling bag, kept in ice box and transported to the laboratory at the same day. Total length was measured from the tip of snout to the tip of the caudal fin (Nehemia et al., 2012). The condition factor was estimated by using the equation:

$$\text{CF} = \frac{100000m}{l}$$

Where, m is the weight of the studied fish in grams, and l is the length of the fish in millimetres. While, HSI is defined as the ratio of liver weight (WL) to body weight (WT).

$$\text{HSI} = \frac{WL}{WT}$$

All data were presented as mean ± standard deviation of mean and analysed with t-test to determine size-differences in fish. Values were considered significant at $p < 0.05$.

3. Results and Discussion

The results of environmental parameters are shown in Table 1. Generally, all environmental parameters were within acceptable range for *Barbonymus schwanenfeldii* growth. However, Sokolova & Lanning, (2008) have suggested the optimal temperature for growth of species study should ranges from 22.2 to 25°C.

Table 1: Environmental parameters

Water temperature (°C)	pH	Conductivity (µS/cm)	Dissolved oxygen (mg/L)	Total dissolved solid (g/L)
27.9 ± 1.4	6.9 ± 1.2	0.1 ± 0.0	2.7 ± 0.2	0.04 ± 0.12

Mean ± s.d, n = 40

A total of 40 *Barbonymus schwanenfeldii* were sampled and measured their weight-length. The weight-length and liver weight are summarized in Table 2. The observed total length ranged from 25.1 to 35.7 cm, whereas to body weight ranged from 208.9 to 455.8 g. Liver weight of *Barbonymus schwanenfeldii* indicated ranged from 5.0 to 9.9 g. There were no significant differences ($p < 0.05$) in the parameters of length-weight for *Barbonymus schwanenfeldii*.

Table 2: Length-weight parameters of *Barbonymus schwanenfeldii*

Body length (cm)	Body weight (g)	Liver weight (g)
31.6 ± 3.6	354.5 ± 76.2	8.3 ± 1.4

All reported value are referred to wet base
Mean ± s.d, n = 40

Result of condition factor and hepatosomatic index (HSI) of *Barbonymus schwanenfeldii* are presented in Table 3. The average of condition factor (K value) obtained indicated that the species studied were in poor condition (Barnham & Baxter, 1998). The lowest K value of fish species might be due to the change in temperature (Alex et al., 2012) and availability of food organisms at a particular time (Gupta et al., 2011). According to Muzzalifah et al. (2015), stated that K value below than 1.0 was due to unsuitable condition in the fish habitat. Environmental factors such as food supply and habitat conditions (temperature, conductivity) have great influence on the health of the fish species (Kumolu-Johnson et al., 2010). Similar study by Abdel-Baki et al. (2011) revealed that poor condition in fish species was due to the elevated amount of metals accumulations in fish body. This statement is supported with study from Rohasliney et al. (2014), where fish species caught in Sungai Kelantan were contaminated with non-essential metals such as cadmium and lead. High level of metal is known to decelerate the growth and development of fish, particularly the developmental stages that resulting in possible changes in fish size (Kasimoglu, 2014).

Alteration in the size of liver has also been of interest as an indicator of contaminants exposure. Study done by Pinkney et al. (2001), found a positive correlation between the hepatosomatic index, the ratio of liver weight to body weight, and the concentrations of contaminants in fish. The increase value of HSI in the present study might refer to the high metabolization of metals in liver due to pollution exposure (Kumari et al., 2014). A number of previous research indicated that fish from pollutants sites had elevated HSI compared to fish from relatively unpolluted sites (Everaarts et al., 1993; Pinkney et al., 2001). Nevertheless, a variety of factors other than contaminants exposure might cause changes in the liver size as well (Fabacher & Baumann, 1985). The liver index (HSI) is known as a useful biomarker to detect the

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hazardous effects of the environmental stressor (Vibhandik, 2013).

Table 3: Condition factor and hepatosomatic index of *Barbonymus schwanenfeldii*

Condition Factor (K value)	Hepatosomatic index
1.2 ± 0.21	2.3 ± 0.1

All reported value are referred to wet base

4. Conclusion

Based on the results of condition factor and hepatosomatic index from this study, *Barbonymus schwanenfeldii* was suggested in poor condition. Therefore, in order to take appropriate curative measures to prevent health risks to local community, determining the condition factor and hepatosomatic index of fish study plays a vital role as a primitive warning of water pollution.

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