

Length-Weight Relationship of Six Fish Species from Sepang Besar River Estuary, Malaysia

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Abstract - Length-weight relationship (LWR) of six fish species from the Sepang Besar River estuary, Peninsular Malaysia were analyzed. A total of 594 individuals belonging to six species namely *Arius sagor*, *Photopectoralis bindus*, *Plotosus lineatus*, *Toxotes chatareus*, *Toxotes jaculatrix*, and *Thryssa dussumieri* collected from April 2014 to February 2015 were measured and weighed. Among them, four species showed positive allometric growth and the other two species showed negative allometric growth. The exponent *b* value of LWR ranged between 2.94 (*Toxotes chatareus*) and 3.50 (*Photopectoralis bindus*). This outcome of the present study has contributed to the knowledge of basic information on the length-weight relationship of six most abundant species in Sepang Besar River estuary which is important for future ecological studies and assist in fishery management. **Copyright** © 2015 Penerbit Akademia Baru - All rights reserved.

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1.0 INTRODUCTION

Mangroves can be defined by its flora and fauna inhabiting the intertidal zone within the tropics and the sub tropics [1]. Usually mangroves can be found at estuary area which it requires salinity environment to live. Mangroves in Peninsular Malaysia are found mainly on the sheltered west coast that borders the Straits of Melaka largely in the states of Kedah, Perak, Selangor and Johor with an estimated area amounting to 107,802 hectares (ha) in 2006 which Perak has the largest mangrove reserves, followed by Johor and Selangor [2].

Fish is an important source of protein and plays an important role in aquatic ecosystem. According to [3], the demand in fishes and fishery resources keep on increasing from year to year. There are various types of fish habitat which consist of ocean, estuaries, rivers and lakes. Estuaries are known as one of the popular breeding and nursery grounds for wide variety of fishes [27]. Many of them are migratory species which use this habitat in their early stage of life cycle. Some of them are permanent residents, which complete their whole life cycle in this ecosystem [4].

Fish species richness in Malaysia amounts to 2243 taxa that includes 413 freshwater species, 1636 marine species, 116 species that migrate from marine to freshwater and vice versa, and 78 species that can adapt to brackish water and freshwater environments [5]. Fishes are effective biological indicators of environmental quality and anthropogenic stress in aquatic ecosystems and are sensitive to water quality changes. Fish is sensitive to water chemistry changes due to different anthropogenic activities from their catchment [6].

Size is generally more biologically relevant than age in fish, mainly because several ecological and physiological factors are more size-dependent than age-dependent. Consequently, direct weight measurements can be time-consuming in the field, therefore length-weight relationships have been used frequently to estimate weight from length [7]. The length-weight relationship determination is commonly be the first step in the study of fish stock assessments and population dynamics [8], which describes the functional regime in weight distribution per unit size of sub-population [9].

According to [25], information of length-weight relationships (LWR) is still scarce for most tropical and sub-tropical fish species. That is including those from Malaysian estuarine ecosystem except several reports such as by Simon and Mazlan [11] and Mansor *et al.*, [10]. In addition, there is study done by Ya *et al.*, [12] related to fish distribution in the Sepang Besar River estuary.

This research attempted to provide baseline information for the growth of most abundant fish species found in Sepang Besar River estuary. The estimated Length-Weight Relationship in this study could provide valuable information for future research in order to make comparison between years and locations. Besides, it could provide information about the well-being of fish species inhabiting the Sepang Besar River estuary.

2.0 METHODOLOGY

2.1 Study Area

This study was done in Sepang Besar River mangroves area (Figure 1), in Selangor. Sepang Besar River estuary was situated next to a popular recreational beaches; the Bagan Lalang beach. It lies between latitude 2°35'30" N and 101°43'1" E longitude seawards, facing the Straits of Malacca. All coordinates for the sampling locations were recorded by global positioning system (GPS) as shown in Table 1. Sepang Besar estuary runs from Sepang town through Sungai Pelek town before reaching the Straits of Malacca. There are fisherman villages, aquaculture sites, charcoal power plants, and development area found within the 5 km radius of the confluence of the river [12]. It has diverse ecosystem and also rich with natural resources. There are very few plant species found in this forest area of which *Rhizophora mucronata*, *Rhizophora apiculata*, *Avicennia alba*, *Sonneratia alba*, *Bruguiera gymnorhiz*, *Ceriops tagal* and *Xylocarpus granatum* are most common. Between all of these species *Rhizophora mucronata* has wide distribution and the highest density with 350 trees per ha [26].

2.2 Sampling Procedures

Fish samples were collected from Sepang Besar estuary in April to June 2014 using gill nets and long lines. The nets were about 92 m long and 2.6 m deep with various mesh sizes (3.17, 5.72, 6.35, 7.00, 7.62 and 11.43 cm). The nets were set perpendicular in the rivers at nine

stations and left for 5 to 6 hours. For sample measurement, the total length (cm) of each individual fish was taken from tip of snout to longest ray of the caudal fin. The total length were measured in centimeters using a measuring board. Then, body weight (g) was measured to the nearest gram using Adam LBK electronic weighing balance [13].

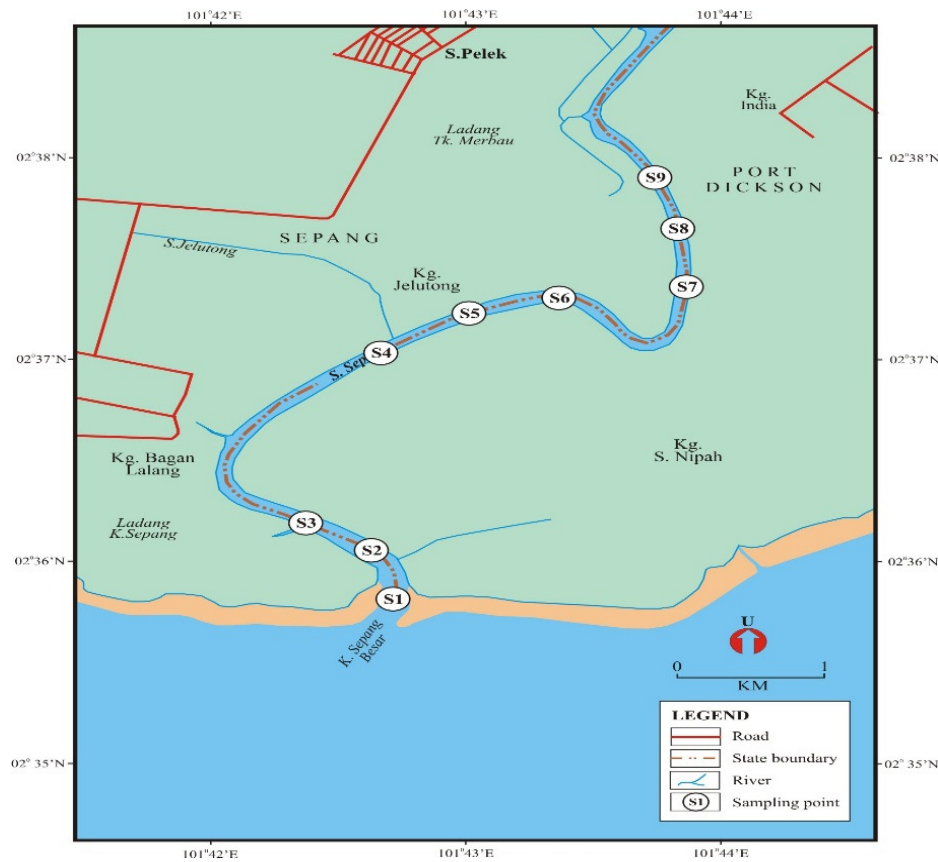


Figure 1: Sepang Besar estuary located at Selangor estate showing sampling locations

Table 1: Sampling Coordinates along Sepang Besar River estuary

STATION	LATITUDE	LONGITUDE
S1	2°35'49.01"N	101°42'49.00"E
S2	2°36'01.00"N	101°42'39.00"E
S3	2°36'09.07"N	101°42'22.00"E
S4	2°36'59.06"N	101°42'49.04"E
S5	2°37'09.79"N	101°43'09.09"E
S6	2°37'14.00"N	101°43'25.89"E
S7	2°37'15.00"N	101°43'49.00"E
S8	2°37'31.43"N	101°43'47.44"E
S9	2°37'53.11"N	101°43'43.00"E

2.3 Data analysis

Length-weight relationships were determined for each fish species by using the $W = aL^b$ equation [14] where W is the weight (g), L is the total length (cm), a is the intercept and b is the exponent which show growth slope.

The statistical significance level of R^2 of the parameters a and b were estimated from a squares linear regression that estimated on the natural logarithms as $\log W = \log a + b \log L$ [15]. Additional, the coefficient of determination (R^2) was used as an indicator of the quality of the linear regression [16]. Then, t-test for the paired samples between total length and weight was conduct with minimum significant level for the relevant test was set at $p < 0.05$ [17].

3.0 RESULTS AND DISCUSSION

51 fish species were measured and weighed in this study. However, only 6 species were chosen for further examination based on their greater abundance (over 30 individuals per species) than other species recorded. A total of six fish species namely *Arius sagor*, *Photopectoralis bindus*, *Plotosus lineatus*, *Toxotes chatareus*, *Toxotes jaculatrix*, and *Thryssa dussumieri* were sampled in this study. Percentage of individuals important fish species between the six species are shown in Fig. 2. *Toxotes jaculatrix* was the most abundant species among them. This species is easier to be caught in group due to their eating behavior which swim near the water surface to get their food by spit the water droplet to the insects [18]. While *Arius sagor* and *Photopectoralis bindus* were listed as the lowest percentage (5%) among the species caught, respectively.

Length-weight relationship of 594 specimens of fish belonging to the six species were presented in Table 2. While the statistical description obtained are given in Table 3. The coefficient of determination (R^2) of the length-weight relationship ranged from 0.86 for *Toxotes jaculatrix* to 0.97 for *Arius sagor* and R^2 values were higher than 0.9 except for 2 species which are *Plotosus lineatus* ($R^2 = 0.87$) and *Toxotes jaculatrix* ($R^2 = 0.86$). High coefficient of determination (R^2) proved a strong relationship between the length and weight in this species [19]. Linear regression were significant for all species ($p < 0.05$).

The b values range from a minimum of 2.76 for *Plotosus lineatus* to a maximum of 3.5 for *Photopectoralis bindus*. In Fig 3, two fish species which are *Plotosus lineatus* and *Toxotes chatareus* had negative allometric growth of ($b < 3$). While *Arius sagor*, *Photopectoralis bindus*, *Toxotes jaculatrix*, and *Thryssa dussumieri* had positive allometric growth with $b > 3$. According to Pervin and Mortuza [20], b values may range from 2.5 to 4.0 suggesting that the result of this study was valid. The b value represent the body form of a fish, which related to the weight which can affected by sex, age, temperature, fishing time and spawning condition [21]. The fish getting slender with increase length when b value less than 3 and fish becomes plump as they increase in length when b value shows higher than 3 [22].

There were many factors affecting the value of b throughout the fish life. Several important factors such as gonad development and the availability of food in their natural habitat at a particular time can greatly affect this growth parameter. The condition of fish also can be determine by polluted and non-polluted environment as well as lotic and lentic environment. For example, fish tend to be heavier in the lotic and lighter in the lentic environment [23]. This

variability of value b occurred might also cause by seasonal fluctuations that reflected in the change of weight over the course of a year or by variability in sampling sites condition [24].

Table 2: Length-weight relationships for the six fish species caught from the Sepang Besar River estuary.

Species	n	a	b	R ²	Growth type	W = aL ^b
<i>Arius sagor</i>	32	0.0033	3.29	0.97	PA	W = 0.0033 L ^{3.29}
<i>Photopectoralis bindus</i>	32	0.0041	3.50	0.91	PA	W = 0.0041 L ^{3.50}
<i>Plotosus lineatus</i>	34	0.0121	2.76	0.87	NA	W = 0.0121 L ^{2.76}
<i>Toxotes chatareus</i>	178	0.0202	2.94	0.90	NA	W = 0.0202 L ^{2.94}
<i>Toxotes jaculatrix</i>	278	0.0126	3.11	0.86	PA	W = 0.0126 L ^{3.11}
<i>Thryssa dussumieri</i>	40	0.0055	3.10	0.94	PA	W = 0.0055 L ^{3.10}

NA= Negative Allometric (b<3), IS= Isometric (b=3), PA= Positive Allometric (b >3)

Table 3: Statistical description obtained for six fish species sampled at the Sepang Besar River estuary.

Species	Length (cm)		Weight (g)	
	min-max	mean ± sd	min-max	mean ± sd
<i>Arius sagor</i>	21.3-43.00	33.88 ± 5.76	80.00-782.00	399.30±198.20
<i>Photopectoralis bindus</i>	7.70-13.00	9.75 ± 1.00	4.00-36.00	12.56±5.31
<i>Plotosus lineatus</i>	17.20-23.00	19.97±1.36	34.00-76.00	48.06±10.50
<i>Toxotes chatareus</i>	10.50-21.00	16.28±1.31	20.00-170.00	74.61±19.66
<i>Toxotes jaculatrix</i>	13.80-22.50	16.53±1.26	44.00-272.00	79.40±22.91
<i>Thryssa dussumieri</i>	10.50-22.00	15.01±2.75	6.00-72.00	27.35±15.78

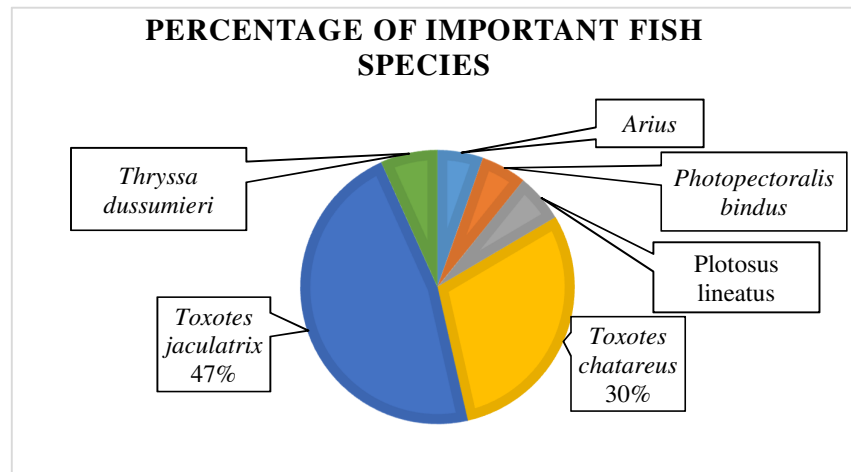


Figure 2: Percentage of important fish species found in Sepang Besar River estuary

Based on this the length-weight analysis performed, the sampled fishes in Sepang Besar estuary were in good condition except *Toxotes chatareus* and *Plotosus lineatus* showed that negative allometric growth. The present data could not clarify which factors among those described above could have led to these observations because lack of other reproductive related knowledge of those species. In future we need to observe their maturity and gonadal

development. In short, the differences in Length-Weight Relationships of all species in this study could be due to the factors mention earlier or a combination of factors which require further investigation.

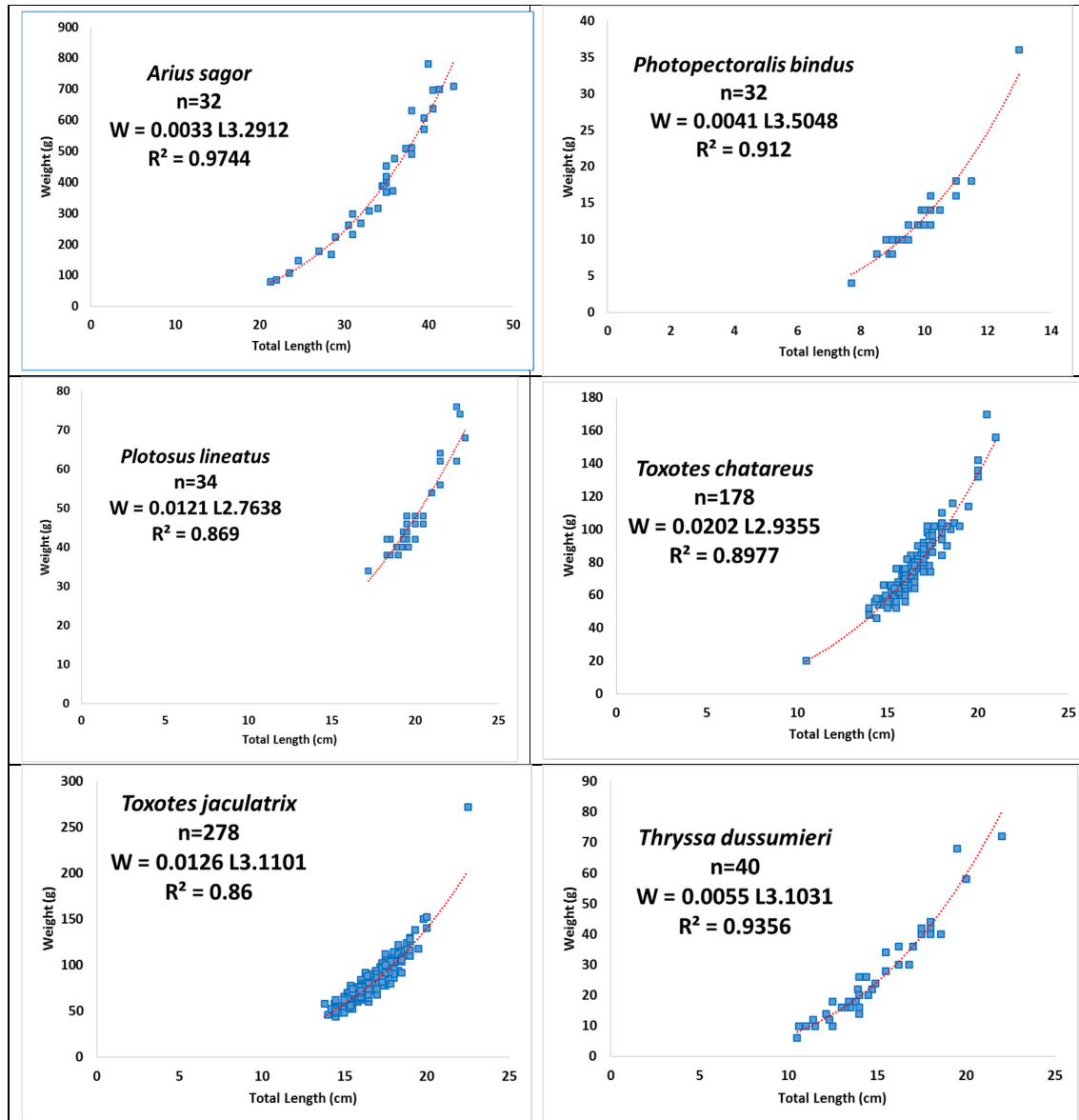


Figure 3: Length-weight relationship of the six fish species from the Sepang Besar River estuary

4.0 CONCLUSION

Length-Weight Relationships of fish population have not previously been recorded from Sepang Besar River estuary. Four species exhibited positive allometric growth while other two species were negative allometric growth. The b value of *Photopectoralis bindus* was the highest

which indicating the Sepang Besar river estuary is provide a favorable environment and suitable habitat for the growth of this species. However further study on the fish condition in relation to the physicochemical parameters and gonadal development in the area should be done to provide better understanding on the healthiness of the ecosystem and management of the fishery resources.

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