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Length-weight Relationship and Condition Factor of Three Dominant Species from the Lake Tasik Kenyir, Terengganu, Malaysia

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ABSTRACT

The Length-weight Relationship (LWR) and condition factor (K) of three most dominant species from the Tasik Kenyir was evaluated from February 2008 to January 2009. The data were analyzed by the equation of $W = aL^b$ and were transferred to $Log_{10} W = Log_{10} a + b \, Log_{10} L$, for the length-weight relationship and $K = W \times 100 \, L^{-3}$ for the condition factor. The relative growth coefficient (b) values for *Barbodes schwanenfeldii* was 2.784, *Notopterus* sp. was 1.905 and *Hampala macrolepidota* was at 3.043. The condition factor values varied seasonally for each species that range from 2.48±0.39 to 2.68±0.28 for *B. schwanenfeldii*, 0.95±0.10 to 1.03±0.20 for *Notopterus* sp. and from 2.17±0.19 to 2.35±0.39 for *H. macrolepidota*.

Key words: Length-weight relationship, lake, Tasik Kenyir, Malaysia

INTRODUCTION

Barbodes schwanenfeldii, Notopterus sp. and *Hampala macrolepidota* are known locally as lampam sungai, belida and sebarau respectively and these species are the most abundant species found in Tasik Kenyir as reported by Kamaruddin *et al.* (2011). However, information on the biological features of these species is very limited.

Recently, the freshwater fish catch in Malaysia including that in Tasik Kenyir has showed a steep decline over the past few years. Habitat degradation and over-exploitation have depleted the fish stocks and reducing the replacement rate in fish population (Khan *et al.*, 1996). Sustainable management and suitable conservation programmes are needed in order to maintain the fish stock in Tasik Kenyir. One of the key factors to successfully maintaining the fish population in the lake is the understanding of some biological fundamental processes of individual fish species.

The Length-weight Relationship (LWR) studies are important in fisheries biology due to that they are useful in estimation of the average weight of fish, based on a given length group which come from the mathematical standard set-up between the two (Beyer, 1987). The length-weight relationships provide information on the growth patterns and condition of one fish (Bagenal and Tesch, 1978). According to Lawson (2011) the investigations on the length-weight relationship studies are important in managing and conserving fish species in one habitat. Meanwhile, the condition factor (K) of fish are actually considering the general well being and health of a fish in relation to its environment, thus it represents how robust or fairly deep bodied of the fish are

(Reynold, 1968). Seasonal variations of K were also observed by previous researchers and according to Gallardo-Cabello *et al.* (2007) the K of fish diminished when the food availability in one area decreased.

As such, the objective of this research is to provide baseline data on the LWR and K of dominant species in Pengkalan Gawi-Pulau Dula section of Tasik Kenyir. This research is believed to be the first that was reported in the lake section and it is hopes to benefits the management of Tasik Kenyir to manage the lake in sustainable ways.

MATERIALS AND METHODS

Tasik Kenyir is the biggest man-made lake in Malaysia with an area about 36,000 ha. The lake lies at 102°32'E to 102°55'E and 4°47'N to 5°15'N in Terengganu. The lake is 145 m above the sea level and the average depth of the lake is about 37 m. It has more than 300 islands and it is paradise for anglers and a pleasant retreat for urban tourists.

Sampling was conducted in one part of the lake comprising an area of about 30 km^2. This section extended from Pengkalan Gawi (the jetty) to the south at Pulau Dula. At this section, fish were sampled at three sampling stations and these stations were designated as stations A (Pulau Dula), station B (Sungai Ikan) and station C (Pulau Pupi). This study was conducted for one year based on monthly intervals from February 2008 to January 2009. Fish sampling was conducted using gillnets with different mesh sizes (2.0, 2.5, 3.0 and 3.5 inches). All fish caught were preserved with ice (Arshad *et al.*, 2008) and were counted and identified for species using standard taxonomic keys following to Mohsin and Ambak (1983).

The standard length (cm) of each individual fish was measured using a measuring board and the body weight (g) was taken using digital balance. The Length Weight-relationship (LWR) was determined by using the equation applied by Ricker (1975):

$$W = aL^b$$

Where:
W = The total weight (g)
L = The total standard length (cm)
a = Constant
b = Growth exponent

A least square linear regression was estimated to make the relationship become linear:

$$\text{Log}_{10}W = \text{Log}_{10}\,a + b\,\text{Log}_{10}\,L$$

The index to quantify the state of condition of a fish followed methods by Tesch (1971) and Weatherley (1972). Condition factor (K) of fish was categorized into four seasonal groups which were February/April, May/July, August/October and November/January. The K value was calculated in percentage as follows:

$$K = W\,100/L^3$$

RESULTS

A total of 98 individual of *B. schwanenfeldii,* 75 individual of *Notopterus* sp. and 44 individuals of *H. macrolepidota* were captured and computed their LWR and K in this study (Table 1). The b

Table 1: Length range and length-weight relationship parameters (a, b and R^2) of three species in the lake Tasik Kenyir, Terengganu

Species of fish	No. of individual	Length range (cm)	a	b	R^2
B. schwanenfeldii	98	10.5-22.9	-1.322	2.784	0.879
Notopterus sp.	75	18.0-28.5	-0.562	1.905	0.592
H. macrolepidota	44	12.5-29.0	-1.704	3.043	0.936

Table 2: The condition factor (K) (mean±SD) for three species in the lake Tasik Kenyir

Months/mean	*B. schwanenfeldii*	*Notopterus* sp.	*H. macrolepidota*
February/April	2.82±0.53[a]	1.03±0.20[a]	2.35±0.39[a]
May/July	2.68±0.28[ab]	0.98±0.16[a]	2.22±0.21[a]
August/October	2.55±0.18[ab]	0.96±0.07[a]	2.17±0.19[a]
November/January	2.48±0.39[b]	0.95±0.10[a]	2.28±0.19[a]
Mean	2.66±0.43	0.99±0.15	2.27±0.28

values (slope) for the LWR of two species were under the expected range from 2.784 for *B. schwanenfeldii* to 3.043 for *H. macrolepidota*, where all of these were determined by coefficients $(R^2)>0.879$. The length-weight equations were calculated as for *B. schwanenfeldii*, $Log_{10}W = Log_{10}-1.322 + 2.784 \ Log_{10}L \ (R^2 = 0.879)$; *Notopterus* sp., $Log_{10}W = Log_{10}-0.562 + 1.905 \ Log_{10}L \ (R^2 = 0.592)$; and *H. macrolepidota*, $Log_{10}W = Log_{10}-1.704 + 3.043 \ Log_{10}L \ (R^2 = 0.936)$.

The mean value of K in different season ranged from 2.48±0.39 to 2.82±0.53 for *B. schwanenfeldii*, 0.95±0.10 to 1.03±0.20 for *Notopterus* sp. and 2.17±0.19 to 2.35±0.39 for *H. macrolepidota*. The highest mean K values for all species were recorded during season February/April (Table 2).

DISCUSSION

Results of the LWR in this study show that the b value (exponent) of *H. macrolepidota* was the highest thus indicates that the environment of the lake section of Tasik Kenyir is more suitable for this species. The finding also shows that the b values of *H. macrolepidota* was higher than 3 (b>3) indicates a positive allometric growths while *B. schwanenfeldii* and *Notopterus* sp. are lower than 3 (b<3) show a signs of negative allometric growths. When b is equal to 3, this indicates that the fish grows isometrically (Amin *et al.*, 2008; Rahim *et al.*, 2009) and the positive or negative allometric growth occurred when the b value was different from 3 (Arslan *et al.*, 2004).

Although, the small number of samples was recorded in this study, the b values remain within the estimated range for *B. schwanenfeldii* and *H. macrolepidota*. Earlier studied done by Tesch (1971) revealed that most fishes in aquatic ecosystems have b values ranged from 2 to 4. The LWR of fishes may be differs among species and affected by factors that were not taken into consideration in this study. Factors that may affect the differences in LWR of fish are the quality and quantity of food available in one area (Sparre and Venema, 1992) and due to the male-female ratio (Amin *et al.*, 2005). On the other hand, Schneider *et al.* (2000) described that the exact relationship between length and weight depending to their body shape and condition (robustness) of individual fish.

Results for the K of fish species in this study indicates that the weight of *B. schwanenfeldii* was heavy for its length, greater when compared to *Notopterus* sp.. According to Wootton (1998), fish species with high values of K are heavy for their length while low values of K are light for their length. The high value of K for all species during February/April indicates that fishes on that season were in a robust condition. According to Gupta *et al.* (2010), this could be due to the

availability of food organisms available on that season and due to the differences of gonad development. The weights of fishes increase when they utilize the food items available for growth and energy (Oniye *et al.*, 2006). This could be a sign that food organisms were available in abundance during season February/April. The differences of LWR and K of all species in this study could be due to the factors listed above or the combinations of the factors.

CONCLUSION

LWR and K of fish population have not previously been recorded from the lake Tasik Kenyir. The b value (exponent) of *H. macrolepidota* and the K values of *B. schwanenfeldii* were the highest indicating that the lake environment is the most suitable to live for both species.

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