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Length-weight Relationships of Seven Catfish Species in Peninsular Malaysia

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ABSTRACT

The study described the Length-Weight Relationship (LWR) of commercially important and indigenous freshwater catfishes from Peninsular Malaysia. Seven species of freshwater catfishes from three families (Bagriidae, Clariidae and Pangasidae) were collected from various rivers in Peninsular Malaysia. Allometric coefficient, b in LWR varied between 2.19 and 3.20. The LWR with high correlation coefficient (r^2) is significant for all species except *P. nasutus*. The present study also documented first reference for *Pangasius nasutus* and *Pseudomystus siamensis*.

Key words: Catfish, length-weight relationship

INTRODUCTION

Length-weight relationship is an important parameter in fish biology to serving as a reference in fish biology for the calculating of unknown weight from known length or vice versa. It has been used extensively in fishery analysis due to difficulties in getting data from the field (Ayoade, 2011; Froese, 2006; Sinovcic *et al*., 2004; Yousaf *et al*., 2009). Weight can be estimated based on length obtained from length-frequency distribution. Also, values of LWR are used for comparison of isometric growth among different regions. In addition, the coefficient of condition factor value can be determined from the data obtained.

Kottelat and Whitten (1996) stated Malaysia as among the 10 richest freshwater fish fauna worldwide. There are about 280 species of freshwater species reported and the figure is now around 300 species. Freshwater catfishes (Suborder Siluroidei) are among the most diverse and studied. Their habitats ranging from small streams to brackish water with some endemic catfishes thrive in acidic and alkaline ecosystems. Studies on species diversity and taxonomic status of catfishes in Peninsular Malaysia showed interesting results. Many new catfish species have been described in Peninsular Malaysia since 1997 until present (Lim and Ng, 1997; Ng and Tan, 1999; Ng and Lim, 2005; Ng, 2010).

Information on fish Length-Weight Relationship (LWR) in Peninsular Malaysia is still scarce except some reports on few native freshwater species (Khaironizam and Norma-Rashid, 2002; Simon and Mazlan, 2008; Isa *et al*., 2010) and some study dated 20 years ago need to be revised (Khan, 1987). In this study, parameters of length-weight relationship of seven catfish species were presented. These species, (*Clarias batrachus*, *C. macrocephalus*, *C. gariepinus*, *Hemibagrus nemurus*, *Pseudomystus siamensis*, *Pangasius pangasius* and *P. nasutus*) can be found in Peninsular Malaysia water bodies (Mohsin and Ambak, 1983). *Clarias gariepinus* was originated

.from Africa and brought to Malaysia for aquaculture purposes during 1970s. *Clarias batrachus*, *C. macrocephalus*, *H. nemurus*, *P. pangasius* and *P. nasutus* are native species and favourable by locals as food fish thus attempt has been made to culture them extensively. *Pseudomystus siamensis* locally known as bumblebee catfish or baung pisang is popular as aquarium fish due to their miniature size and unique colour pattern.

MATERIALS AND METHODS

A totally 210 catfish species were sampled from the wild in various sampling locations in Peninsular Malaysia (Table 1) except for *Clarias gariepinus* which was taken from UPM Hatchery in Puchong, Selangor. Two fishing gears were used (hook and line, traditional fish trap). Measurement of Total Length (TL) and Standard Length (SL) were determined by using digital vernier caliper to the nearest 0.1 cm and body Weight (W) was measured with digital balance to the nearest 0.01 g.

Length-weight parameters were estimated for the entire sample of each species according to the following formula:

$$w = aLb \quad (1)$$

where, W is total weight in grams, L is total length in centimeters, a is coefficient related to body form and b = exponent indicating isometric growth when the value is 3. The values of a and b were estimated by performing linear regression on log transformed equation: log W = log a+b log L. The parameters a and b were estimated by using linear regression on the transformed equation: Log W = log a+b log L (Le Cren 1951). The statistical analysis was considered significant at $p < 0.05$. After that, graph of log weight against log total length was plotted for all species.

RESULTS

Length-weight relationships of 210 specimens of seven catfish species belonging to three families were calculated. Sampling location and size range (cm, TL) are presented in Table 1. Length-weight parameters a, b and the correlation coefficient (r^2) are given in Table 2. Plots of log weight against log total length in arithmetic forms yield linear correlations and can be used in equation listed in Table 3 to estimate the weight.

The coefficient of determination (r^2) of the length-weight relationship ranged from 0.572 for *Pangasius nasutus* to 0.965 for *Pseudomystus siamensis* and r^2 values were higher than 0.9 with exception for 3 species: *H. nemurus* (r^2 = 0.836), *P. pangasius* (r^2 = 0.823) and *P. nasutus* (r^2 = 0.572). All linear regressions were highly and statistically significant ($p < 0.05$). The b values ranged from a minimum of 2.19 for *C. batrachus* to a maximum of 3.2 for *H. nemurus*. Two species showed positive allometric growth (b>3) and four species showed negative allometric growth (b <3).

Table 1: Species, localities, sample size (n) and size statistics of catfishes

Species	Location	n	Total length (cm) range	Weight(g) range
Hemibagrus nemurus	Perak	30	20.5-45.0	70.0-760.0
Pseudomystus siamensis	Negeri Sembilan	30	70.2-14.3	4.0-32.0
Pangasius pangasius	Perak	30	31.0-38.0	230.0-535.0
Pangasius nasutus	Selangor	30	37.0-52.0	540.0-1500.0
Clarias batrachus	Pahang	30	16.8-24.9	46.3-94.9
Clarias macrocephalus	Pahang	30	19.8-33.6	60.0-260.0
Clarias gariepinus	Selangor	30	19.6-35.4	50.0-270.0

Table 2: Length-weight relationships of seven freshwater catfish species

Species	a	b	r^2	Growth type
Hemibagrus nemurus	-2.28	3.15	0.836	Positive allometric
Pseudomystus siamensis	-2.19	3.20	0.965	**Positive allometric**
Pangasius pangasius	-1.64	2.72	0.823	**Negative allometric**
Pangasius nasutus	-1.32	2.57	0.572	**Negative allometric**
Clarias batrachus	-1.03	2.19	0.946	**Negative allometric**
Clarias macrocephalus	-1.82	2.79	0.951	Negative allometric
Clarias gariepinus	-1.86	2.76	0.906	**Negative allometric**

Species written in bold indicate no previous document recorded

Table 3: Length-weight relationships equation for each catfish species

Species	Equation
Hemibagrus nemurus	Log W = -2.28+3.15 log TL
Pseudomystus siamensis	Log W = -2.19+3.2 log TL
Pangasius pangasius	Log W = -1.64+2.72 log TL
Pangasius nasutus	Log W = -1.32+2.57 log TL
Clarias batrachus	Log W = -1.03+2.19 log TL
Clarias macrocephalus	Log W = -1.82+2.79 log TL
Clarias gariepinus	Log W = -1.86+2.76 log TL

DISCUSSION

Among seven species studied, only the LWR of *H. nemurus* and *C. macrocephalus* has been documented (Khan, 1987; Ali, 1993) and recorded in Malaysia. The other five species for which no LWR were recorded in Malaysia (Froese and Pauly, 2011). Coefficient of determination has been reported to be relatively high ($p>0.95$) in Family Bagridae (Hossain *et al.,* 2006; Sani *et al.,* 2010) and Family Pangasiidae (Somroo *et al.,* 2007). Relatively low value of coefficient of determination ($r^2<0.9$) observed in catfish from these two Families may be due to several factors such as gut fullness, maturity stage and narrow length range (Tarkan *et al.,* 2009; Hussain *et al.,* 2010).

Rahim *et al.* (2009) suggested the fish grow at isometric rate when the b equal to 3. In this study, all seven species showed either positive allometric or negative allometric growth. The positive or negative allometric growth occurred when the b value was different from 3 (Amin *et al.*, 2008; Hossain *et al.*, 2006). The estimated b values were higher than 3.0 showed positive allometric growths for bagrid catfishes *Hemibagrus nemurus* and *Pseudomystus siamensis*. Meanwhile, the values of *b* were lower than 3.0 is considered negative allometric growth, in this study clariid and pangasiid catfishes fall in this category.

Positive allometric growth (a = -2.19, b = 3.114) in *Hemibagrus nemurus* from Perak (Khan, 1987) showed slight difference from the present study (a = -2.28, b = 3.15). Studied of other bagrid catfish species also showed positive allometric growth (Hossain *et al.,* 2006; Begum *et al.,* 2008). *Clarias macrocephalus* length weight relationship has been assessed by Ali (1993) in North Kerian, Perak which showed negative allometric growth (a = 0.011, b = 2.945) and agreed with present study. Study on LWR of *C. batrachus* (De, 1985) in India showed negative allometric growth (a = 0.024, b = 2.5). Similar pattern was also observed in *C. gariepinus* (a = 0.013, b = 2.82) in Turkey (Yalcin *et al.,* 2002). Length weight relationship study of *P. pangasius* by Ramakrishniah (1986) in Indonesia and India also showed negative allometric growth (a = 0.008, b = 2.948). Increased of b value in *H. nemurus* may be due to increase of food availability in their habitat compared to 24 years ago. The change of b values depends primarily on the body shape and

fatness of the species (Cherif *et al.,* 2008). Body shape of clariid catfish is compressed and elongated, while pangasid catfish have elongated and vertically flat body shape. This may be the reason that most species from these two families have negative allometric growth. Seasonal changes, ontogenetic changes, habitat, gonad maturity, sex, diet and stomach fullness, health and preservation methods have been identified to influence the length-weight relationships (Hossain *et al.,* 2006) although, they were not considered in the present study.

Documentation of length-weight relationship of fish species in Malaysia is still scarce (Arshad *et al.,* 2008). There is no documented information about LWR of *P. nasutus* and *P. siamensis* from previous study. In comparison, the data of LWR for most fish species in temperate region are recorded extensively (Craig *et al.,* 2005; Orlov and Binohlan, 2009; Vallisneri *et al.,* 2010).

CONCLUSION

In conclusion, bagrid catfishes showed positive allometric growth while the other two families (Pangasidae and Clariidae) showed negative allometric growth even when assessed in various places. For bagrid catfish, the b value is 3.15 and 3.2 in *H. nemurus* and *P. siamensis*, respectively. In pangasid, the b value is 2.72 in *P. pangasius* and 2.57 in *P. nasutus*. Clariid catfishes have b value 2.79 in *C. macrocephalus*, 2.72 in *C. gariepinus* and 2.19 in *C. batrachus*. The information from present study can help fish biologist to estimates weight of seven catfish species based on their length measurement.

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