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Meristic, Morphometrics and Length-weight Relationship of Tropical Silverside, *Atherinomorus duodecimalis* (Valenciennes in Cuvier and Valenciennes, 1835) in Seagrass and Mangrove Habitats of Tinggi Island, Johor, Malaysia

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ABSTRACT

The present study describes the meristic, morphometric and Length Weight Relationship (LWR) of tropical silverside, *Atherinomorus duodecimalis* (Atheriniformes: Atherinidae) an important fishery in the Sea grass and mangrove habitat of Tinggi Island, Johor, Malaysia. A series of sampling survey was conducted in seagrass and mangrove habitats of Tinggi Island, using beach seine net. A total of 94 specimens (3.7-10.3 cm TL) used in this study. The results showed that meristic and morphometric features of the fish studied agreed well with a description of the holotype specimen MNHN A. 4382 and other silverside specimens. The only exception was observed in the upper jaw length and eye diameter as a percentage of head length. The allometric coefficient 'b' of the length weight relationship indicated negative allometric growth (b<3.0) in seagrass habitat and positive allometric growth (b>3.0) in mangrove habitat. To the best knowledge of the authors, this study presented the first reference on LWR for this species from Johor waters, Malaysia.

Key words: Population growth, *Atherinomorus duodecimalis*, habitat, mangrove, coastal waters

INTRODUCTION

The atherinid tropical silverside *A. duodecimalis* (family Atherinidae) is stenohaline fish and widely distributed in the eastern Indian and West Pacific Oceans (Ivantsoff and Crowley, 1991; Takemura *et al*., 2004). This fish species is commonly available in shallow coastal waters, estuaries, mangrove habitats and seagrass habitats (Matsuura and Kimura, 2005). It usually occurs in schools along shorelines and underneath the jetty facilities of the populated islands. Planktonic eggs of this species are easily recognized by observing the entangling filaments on chorion membrane.

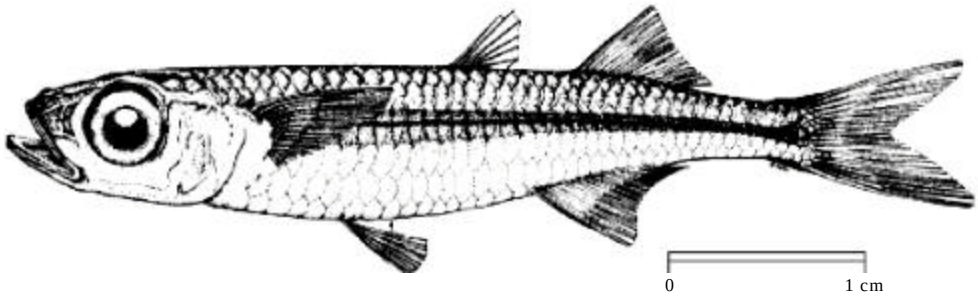

Fig. 1: *Atherinomorus duodecimalis* (Carpenter and Niem, 1999)

This fish is important as forage for commercial fishes and used as bait and dried cat food (Ivantsoff and Crowley, 2000). Detail studies on the meristic, morphometric characteristic and length-weight relationship of *A. duodecimalis* (Fig. 1) are still lacking in Malaysia coastal waters.

Comparing anatomical features of organisms has been the basis for taxonomic classification of organisms and differentiation among stocks as well as closely related species. Those comparisons are usually carried out using differences in body measurements (morphometry) or differences in numbers of anatomical structures (meristics) (Bagenal, 1978; Bookstein, 1991).

LWRs are useful in fishery management for both applied and basic use (Pitcher and Hart, 1982) to: (i) estimate weight from length observations, (ii) calculate production and biomass of a fish population and/or (iii) provide information on stocks or organism condition at the corporal level.

Therefore, in the present study, we examined the meristic, morphometric characteristic and LWR of *A. duodecimalis* available in the seagrass and mangrove habitats of Tinggi Island, Johor, Malaysia.

MATERIALS AND METHODS

A series of catch survey was carried out in the seagrass and mangrove habitats of Tinggi Island, Johor using beach seine net (100 ft×6 ft; 5 mm mesh size) from January 2008 to December 2009. All catches were sorted in accordance to the standard protocol listed by Sparre and Venema (1998). Fresh sub-samples were kept in the ice chest prior to further biological investigation at Tinggi Island field-laboratory. Species identification was made in accordance to Masuda *et al.* (1984), Ivantsoff and Crowley (2000), Matsuura *et al.* (2000), Kimura *et al.* (2001) and Kimura and Matsuura (2003). Counts and measurements generally followed Hubbs and Lagler (1958) and Simon *et al.* (2010a). All measurements were made with a digital caliper (absolute digimatic digital calipers, Mitutoyo, Japan) to the nearest 0.01 cm and weighed to the nearest 0.1 g. All sub-samples were then fixed in 10% formalin prior to the laboratory analyses and further preserved in the 70% alcohol. Length-weight Relationships (LWRs) were calculated using the allometric regression analysis ($W = aL^b$) (Le Cren, 1951; Abdallah, 2002; Ekelemu and Samuel, 2006; Bayhan *et al.*, 2008; Simon *et al.*, 2009; Ozvarol *et al.*, 2010; Sivashanthini *et al.*, 2009; Bok *et al.*, 2011; Sasi and Berber, 2012).

RESULTS AND DISCUSSION

In this study, a total number of 94 *A. duodecimalis* individual was collected from seagrass (n = 47) and mangrove habitats (n = 47). Meristic counts and measurements of this individual are

Table 1: Counts and measurements of the holotype, other specimens and Tinggi Island specimens of *Atherinomorus duodecimalis*

	Holotype MNHN A. 4382	Other specimens (n = 67)	Tinggi island (n = 94)
Standard length (mm)	66	33-76 (66.6)	(43.3)
Counts			
1st dorsal fin rays	V	V-VI (5.3)	V-VI
2nd dorsal fin rays	I, 9	I, 8-11 (9.3)	I, 8-10
Anal fin rays	I, 12	I, 11-14 (12.2)	I, 11-14
Midlateral scales	36	35-38 (36.6)	35-38
Measurements			
As % of standard length			
Head length	27	25-30 (27.9)	(28.4)
Predorsal length	56	50-60 (55.0)	(55.2)
Snout to 2nd dorsal fin origin	72	68-76 (71.8)	(71.8)
Distance between origins of 1st and 2nd dorsal fins	17	15-22 (17.2)	(16.8)
Snout to pectoral fin origin	27	26-30 (27.8)	(29.0)
Snout to pectoral fin tip	Damaged	43-54 (49.4)	(48.4)
Pectoral fin length	Damaged	16-26 (22.2)	(19.5)
Snout to pelvic fin origin	40	38-45 (41.5)	(41.3)
Snout to pelvic fin tip	53	51-61 (55.8)	(53.3)
Snout to anus	52	46-54 (50.7)	(49.2)
Pelvic fin length	14	12-17 (15.4)	(14.1)
Caudal peduncle length	17	15-20 (17.7)	(17.1)
Body depth	20	19-25 (21.9)	(18.5)
Caudal peduncle depth	7	7-9 (8.0)	(7.3)
As % of head length			
Snout length	22	19-29 (23.9)	(24.5)
Upper jaw length	38	32-43 (37.7)	(26.6)
Eye diameter	47	39-48 (43.4)	(36.7)
Postorbital length of head	36	33-43 (37.8)	(36.9)
Interorbital length	36	30-61 (34.6)	(35.0)
As % of pelvic fin length			
Pelvic fin origin to anus	70	45-89 (65.2)	(63.4)
As % of caudal peduncle depth			
Width of midlateral band	54	35-60 (47.0)	(54.1)

Figures in parentheses indicate mean values, holotype and other specimen's measurements were taken from Kimura *et al*. (2001)

shown in Table 1. Measurements of morphometric characteristic were given in mean values and expressed in relative percentage to standard length, head length, pelvic fin length and caudal peduncle depth. Relationship between morphometric parameters with standard length of *A. duodecimalis* from seagrass and mangrove habitats are shown in Fig. 2. Two different habitats displayed different size fishes have been caught in this study but established totally similar pattern of morphometric characteristic in relationship with standard length.

In general, the meristic and morphometric positions of the fishes studied agreed well with the holotype specimen MNHN A. 4382 and other silverside specimens documented by Kimura *et al.* (2001). The only exceptions were slight differences in the upper jaw length and eye diameter (expressed as a percentage of head length). Variations occur in meristic and morphometric characteristic among similar species of fish from different geographic location were reported to be influenced by the environmental variables (Jennings *et al.*, 2001; King, 1995; Bagenal, 1978). Detail population growth condition of this species was estimated using the allometric regression analysis ($W = aL^b$).

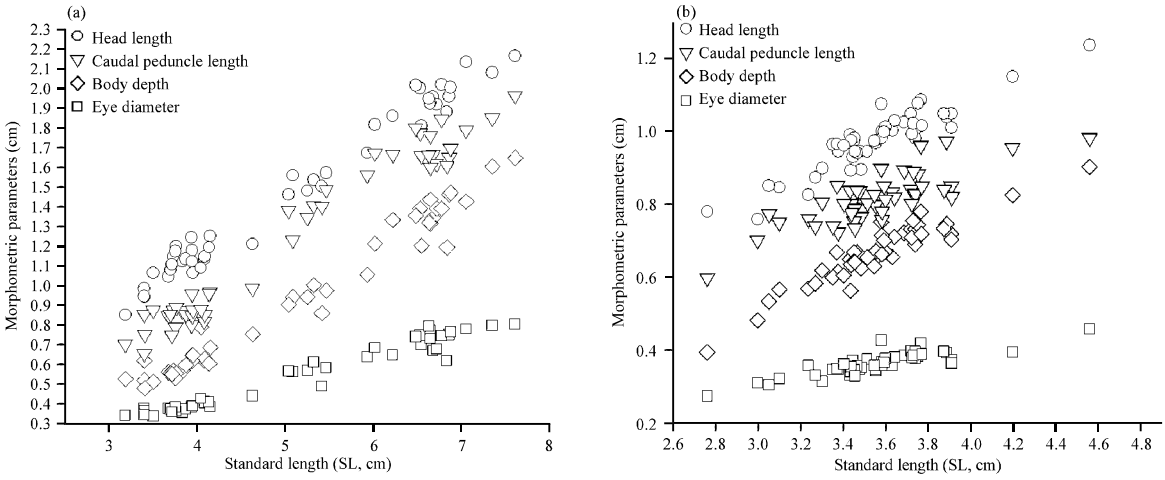

Fig. 2(a-b): Relationship between morphometric parameters with standard length of from (a) Seagrass habitat and (b) Mangrove habitat

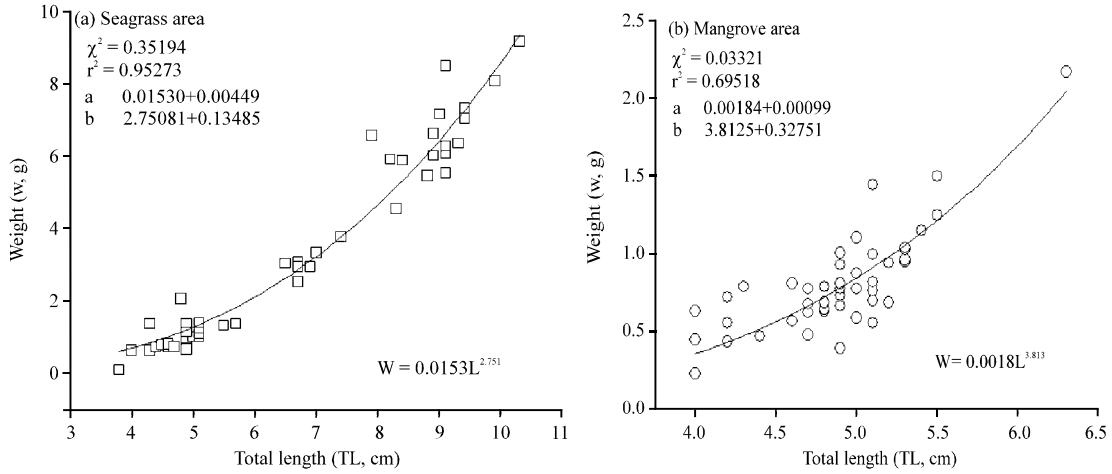

Fig. 3(a-b): Length-weight relationship of *Atherinomorus duodecimalis* from (a) Seagrass habitat and (b) Mangrove habitat

The results showed that the regression coefficient 'b' of *A. duodecimalis* was 2.75±0.13 (χ^2 = 0.352; r^2 = 0.953) for seagrass habitat and 3.81±0.33 (χ^2 = 0.033; r^2 = 0.695) for mangrove habitat (Fig. 3). The specimens collected from the seagrass habitat were found larger in size compared with collected from mangrove habitat. However, the population growth pattern as elucidated from a regression coefficient 'b' values demonstrated different pattern of a population growth conditions between these two habitats. The results indicated that atherinids collected from seagrass habitat displayed a negative allometric population growth pattern (b<3.0), in comparison with the fish collected in the mangrove habitat displayed a positive allometric population growth pattern (b>3.0).

The results also denoted that fishes collected from mangrove habitat have a weight increase faster than length, showing that this habitat provides abundant food supply in comparison to seagrass habitat. The functional roles of mangrove's environment as major feeding and nursery

ground for wide ranges of euryhaline fish species are documented (Faunce *et al*., 2004; Robertson and Duke, 1987). However, the 'b' values also changes due to changes in physiological growth condition such as food availability and gonads development for the respective population (Le Cren, 1951; Jennings *et al*., 2001; Simon *et al*., 2010b).

CONCLUSIONS

This study has described the meristic, morphometric and length-weight relationship of *A. duodecimalis* in Malaysian coastal waters. The results showed that meristic and morphometric features of the fish studied agreed well with the description of the holotype specimen MNHN A. 4382 and other silverside specimens. However, this study also reported the distinction in the upper jaw length and eye diameter as a percentage of head length from the holotype MNHN A. 4382 and other silverside specimens. The LWR obtained from the present study showed negative allometric growth ($b<3.0$) in seagrass samples while positive allometric growth ($b>3.0$) in mangrove samples. To the best of our knowledge, this study presented the first reference on the LWR for this fish species from Johor waters, Malaysia. Recent development in taxonomic revisions among the atherinids fish has revealed a need to re-describe a group of morphologically similar silverside in the Malaysian coastal waters.

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