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ORIGINAL ARTICLE

Morphometric Relationship of Weight and Size of Clam *Amiantis umbonella* L., 1818 (Bivalvia: Veneridae) In the Eastern Coasts of Bandar Abbas, Persian Gulf

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Mohsen Mekhanik Babaei, Homayon Hosseinzadeh Sahafi, Aria Ashja Ardalan; Morphometric Relationship of Weight and Size of Clam *Amiantis umbonella* L., 1818 (Bivalvia: Veneridae) In the Eastern Coasts of Bandar Abbas, Persian Gulf

ABSTRACT

Clams are commercially important species in the whole world and also are significant bioindicators in the marine environment. ***Amiantis umbonella*** is Located in wide tidal areas of eastern coasts of Bandar Abbas, Persian Gulf. This kind of species belongs to the Veneridae family. The purpose of this study is to analyze the morphometric relationship between length (APM) and height (DVM) with total weight, visceral mass weight and shell weight .In this study 1440 Clams ***(Amiantis umbonella)*** were collected between June 2009 and May 2010 from Eastern coasts of Bandar Abbas (Golshahr). Sampling location was in Lat. 27°, 10', 56.2" N; and Log. 56°, 21', 9.8" E;. After sampling, samples were transferred to the laboratory for each length was measured as well as height and weighed (total weight, visceral mass weight and shell weight). Average length (APM) and height (DVM) were 41.55 ± 0.22 and 34.80 ± 0.18 mm respectively and the average total weight, visceral mass weight and shell weight were 21.66±0.34, 3.22±0.05 and 18.27±0.29 g respectively. Determination coefficient values (r^2) between height-length, total weight-length, visceral mass weight-length and shell weight-length, were 0.987, 0.976, 0.904, 0.972, respectively and also between total weight-height, visceral mass weight-height and shell weight-height, were 0.985, 0.909, 0.982, than in all cases significant correlation are showed $(P < 0.01)$.

Key words: *Amiantis umbonella;* Morphometric Relationship; Length; Height; Weight

Introduction

Mollusca (mol-lus ´ka) (L. *molluscus*, soft) is one of the largest animal phyla after Arthropoda. [9] Yet Mollusca constitute a remarkably large and wide-ranging phylum of at least 100,000 species. Bivalves are very common animals, with about 8000 known species[15]. The molluscs are more distinctive phylum than the EutroChozoa worms, especially the peanut worms (Sipuncula) have been the origin [3]. The class Bivalvi is the second largest molluscan class. This class Bivalvia includes the clams, oysters, mussels, and scallop [14]. Biodiversity of Persian Gulf molluscs especially bivalvia, potential is considerable. Bivalvia applications, including food consumptions, medicinal, decorative, Research, Pearl building and industrial consumptions. Therefore, these creatures play an important role in the countries economy. Clams are commercial important species in the world and also are significant bioindicators in the marine environment. ***Amiantis umbonella*** is localized and found more in wide tidal areas of eastern coasts of Bandar Abbas, Persian Gulf. This species belong to super order Heterodonta, order Veneroida and

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family Veneridae. Its shell is ovate or ovate-triangular in shape, up to 80mm in length, with each valve bearing three cardinal teeth. The variety of this species in colour is from white to violet with distinctive brown zigzag markings at the umbo. This species is both used for human consumptions and as bait in fisheries for local people. Investigation morphometric relationship (size- weight) on this species have not studied in the northern Persian Gulf yet. Thus, the study of morphometric relationship ***Amiantis umbonella*** is important for stock assessment and management of fisheries. Size and weight are two basic components in the biology of species at the individual and population levels. Information on Length- weight relationship **(LWR)** is essential for proper assessment and management of these fisheries [16]. The size–weight data are also employed in physiological investigations, and to obtain estimates of seasonal variation in growth or productivity [8]. The purpose of this research is to investigate the morphometric relationship between length (APM) and height (DVM) with total weight, visceral mass weight and shell weight. In another research conducted by Satit Kovitvadhi *et al*., (2008) weight and size relationship of cultured freshwater pearl mussel were monitored also Miguel B. Gaspar *et al*., (2002) investigated Shell morphometric relationships of the most common bivalve species of the Algarve coast (southern Portugal), besides Park & Oh (2002) showed length-weight relationship of bivalves from coastal waters of Korea. Cemalettin SAHIN, *et al*., (1999) studied the population growth parameters of *Anadara cornea* by Bhattacharya method in East Black Sea.

Materials and Methods

Study site

Persian Gulf is a semiclose sea in the Middle East. Bandar Abbas port is in the north of Hormuz Strait. Location sampling is in Lat. 27°, 10', 56.2" N; and Log. 56°, 21', 9.8 " E ; (Fig. 1). Eastern coasts of Bandar Abbas due to the very low gradient and tidal zone at several kilometers given that in most parts of this area there are soft sediments.

Sampling

Samples (n=120) of ***Amiantis umbonella*** were collected at monthly intervals from east coast of Bandar Abbas (Golshahr) between June 2009 and May 2010. Sampling was performed in maximum low tide in each month. Samples were usually collected from sediment's surface and tidal pools. In months with drastic changes in temperature, samples were collected by shovel from inside the sediments. Overall, 1440 samples were collected.

Laboratory Experiments

Samples were transferred alive to laboratory after washing with sea water. Initially length (APM =AnterioPosterior Measurement) and height (DVM= DorsoVentral Measurement) of each specimen were measured to the nearest 0.01 mm using electronic caliper [6]. Adductor muscles were cut by using scalpel through the valves. Afterward, the water inside the clams were removed and total weight, visceral mass weight and shell weight were measured to the nearest 0.01 g.

Morphometric Relationships

The estimation of the morphometric relationships between these variables was made by the adjustment of a linear function to the data [17]:

$$\log Y = \log a + b \log X$$

Where log Y and log X are the log shell size (height and width) or total body weight and log shell size (length, height and width), respectively, while log a is the intercept and b is the slope. The association degree between variables was calculated by the determination coefficient (r^2). The values of b obtained in the linear regression were significantly different from the isometric value (b = 1) or allometric range (negative allometry: b< 1 or positive allometry: b>: 1) when a *t*-test (H0: b = 1) with a confidence level of 95% was applied, expressed by the following equation [19,13]:

$$t_s = \frac{b - 1}{Sb}$$

Where t_s = *t*-test value; b = slope (relative growth rates of variables); Sb = standard error of the slope (b).

Statistical analysis

The descriptive statistics of different items and also morphometric relationships of height-length, total weight-length, visceral mass weight-length and shell weight-length as well as total weight-height, visceral mass weigh-height and shell weight-height, determined and analyzed by statistical software Spss 16.0. Forth coming graphs are drawn by Microsoft Office Excel 2007.

Results

The descriptive statistic includes, mean, standard error, minimum and maximum of length, height, total weight, visceral mass weight and shell weight (Table 1). Data collected from 1440 specimens were used to determine the morphometric relationships including shell size (length, height) and weight (total, visceral mass and shell)(Tables 2). The determination coefficient (r^2) between shell size (length, height) and weight (total, visceral mass and shell) were

calculated *(P* < 0.01). In all cases, values of the determination coefficient *(r^2)* were close to 1, but

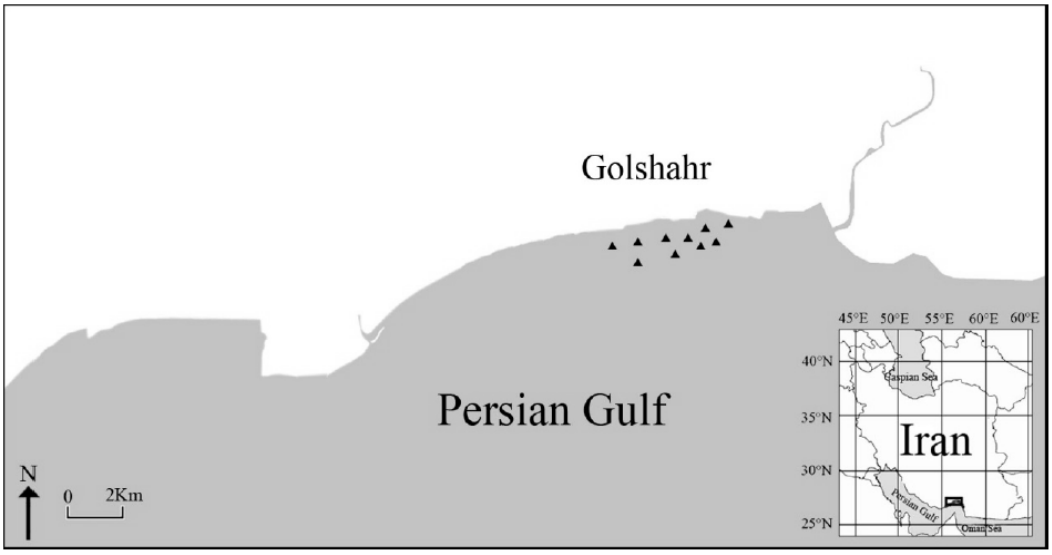

Fig. 1: Location of the sampling station in the eastern coasts of Bandar Abbas, Persian Gulf.

Table 1: Descriptive statistics parameters of ***Amiantis umbonella*** between June 2009 and May 2010 (N=1440).

Parameters	Mean		minimum	maximum
	Statistic	Std. Error		
Length (mm)	41.558	±0.228	17.58	69.52
Height (mm)	34.808	±0.189	14.42	55.45
Total weight (g)	21.665	±0.348	1.26	74.79
Visceral mass weight (g)	3.223	±0.054	0.24	12.58
Shell weight (g)	18.274	±0.294	0.93	61.81

Table 2: Morphometric relationship parameters of ***Amiantis umbonella*** between June 2009 and May 2010 (N=1440). *L* = length (mm); *H* = Height (mm); *TW* = Total weight (g); *VMW* = Visceral mass weight (g); *SW* = Shell weight (g); C.I. = confidence interval; (*)*P* < 0.01

Allometric Relation	Allometric Equation	Determination coefficient (r^2)	S.E. of b (95% C.I. of b)	Relationship (t-test)
H/L	Log H= -0.061+0.990 Log L	0.987*	0.003 (0.984-0.996)	-Allometry
TW/L	Log TW= -3.780+3.124 Log L	0.976*	0.013 (3.099-3.149)	+Allometry
TW/H	Log TW= -3.581+3.151 Log H	0.985*	0.010 (3.130-3.171)	+Allometry
VMW/L	Log VMW= -4.478+3.041 Log H	0.904*	0.026 (2.990-3.092)	+Allometry
VMW/H	Log VMW= -4.274+3.060 Log H	0.909*	0.026 (3.010-3.110)	+Allometry
SW/L	Log SW= -3.878+3.138 Log L	0.972*	0.014 (3.111-3.166)	+Allometry
SW/H	Log SW= -3.679+3.166 Log H	0.982*	0.011 (3.144-3.188)	+Allometry

invariably H/L relationship was greater than all cases. The determination coefficient *(r^2)* of TW/L & TW/H relationships were higher than SW/L & SW/H relationships .The determination coefficient *(r^2)* of VMW/L & VMW/H relationships were lower than all cases. The graphs of morphometric relationships between length with height and weight (total, visceral mass and shell) are respectively shown in Figs. 3–6, and between height with weight (total, visceral mass and shell) respectively in Figs. 7–9. The morphometric relationship of H/L showed negative allometry relation.

Discussion

The studies which examine size-weight relationship in clams of Persian Gulf, especially Bandar Abbas are rare. Gaspar *et al*. (2002) sampled most common bivalve species of the Algarve coast ,southern Portugal, found that A variety of environmental factors are known to influence shell morphology and the relative proportions of many bivalve species. Similarly, in a study Satit Kovitvadhi *et al*. (2008) studied weight and size relationship of cultured freshwater pearl mussel. Their results showed that significant differences in the mussel shell size– weight ratio *(P* < 0.01). Our results reveal significant differences in shell size–weight ratio. Analysis shows that the exponents of the weight–size

ratio (b) of clam ***Amiantis umbonella*** were significantly higher than 1.0 and the exponent of the length–height relationship (b) was near to 1.0 *(P* < 0.01). Bivalve shell growth and shape are influenced by biotic (endogenous/ physiological) and abiotic (exogenous/environmental) factors.For examples, the type and quality of phytoplankton as a food source of the mussels [2], water quality [12], water depth [5], currents [4], water turbulence [10], type of

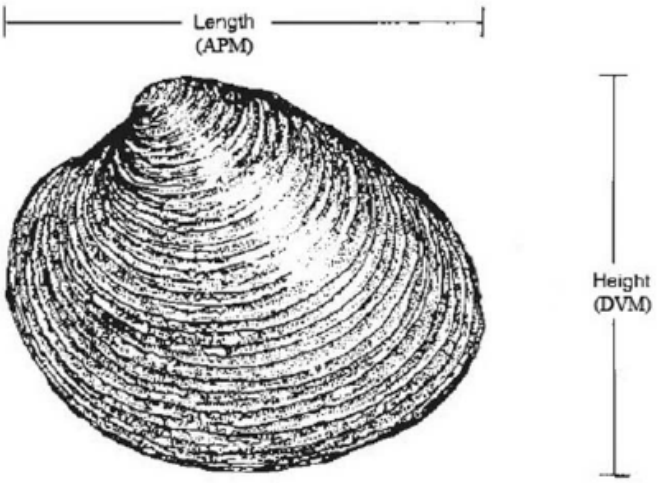

Fig. 2: Morphological measurements of the shell in *Amiantis umbonella*.

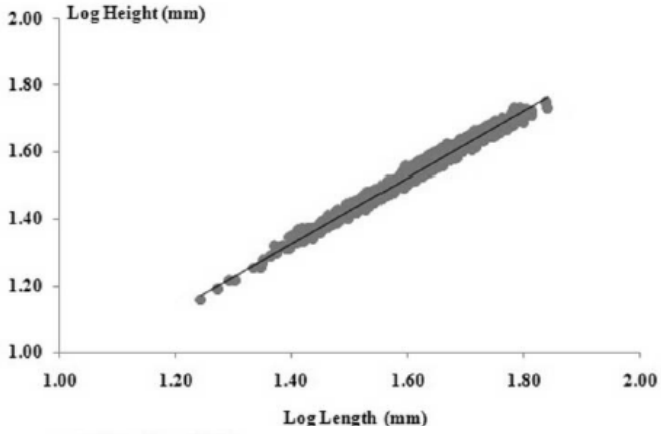

Fig. 3: Morphometric relationship between log length and log Height of *Amiantis umbonella* (N=1440).

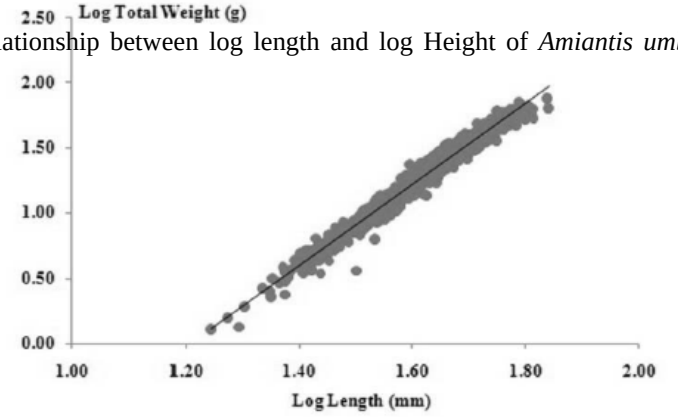

Fig. 4: Morphometric relationship between log length and log Total weight of ***Amiantis umbonella*** (N= 1440).

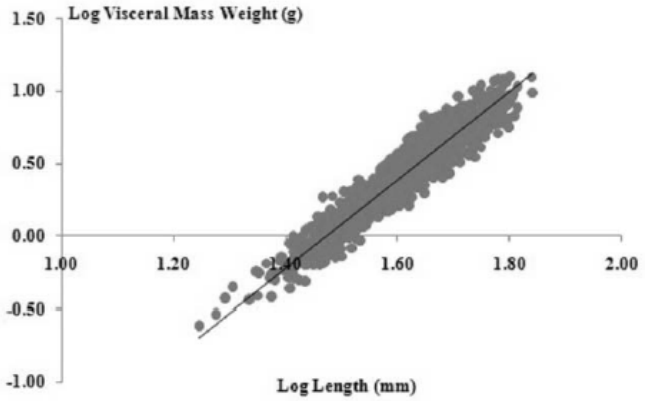

Fig. 5: Morphometric relationship between log length and log Visceral mass weight of ***Amiantis umbonella*** (N= 1440).

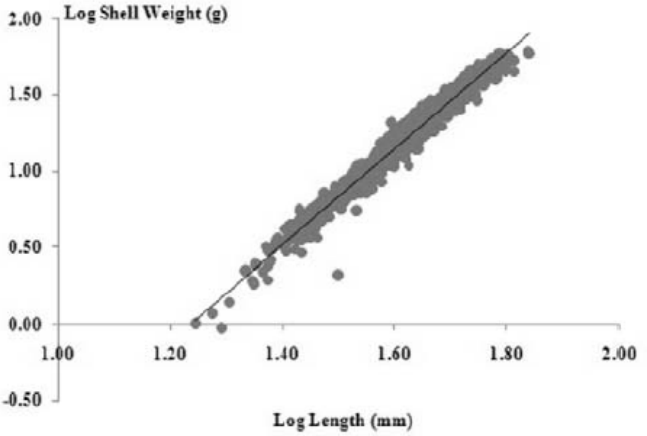

Fig. 6: Morphometric relationship between log length and log shell weight of *Amiantis umbonella* (N=1440).

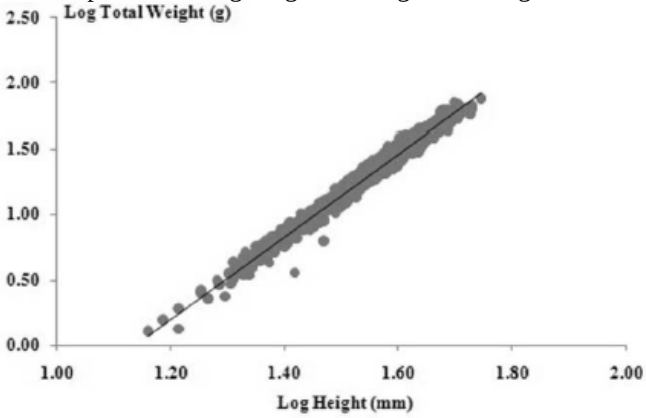

Fig. 7: Morphometric relationship between log Height and log Total weight of ***Amiantis umbonella*** (N= 1440).

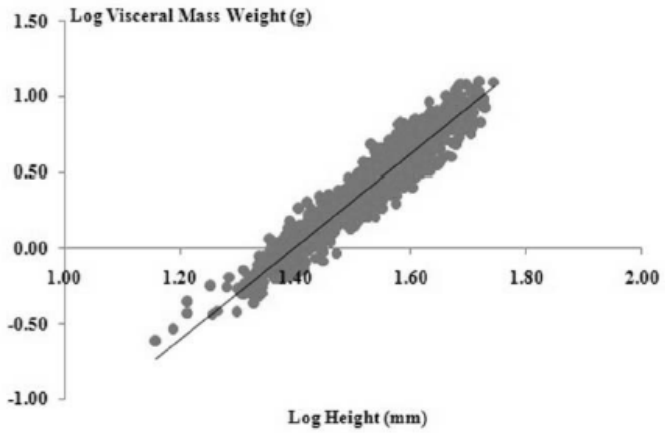

Fig. 8: Morphometric relationship between log Height and log Visceral mass weight of ***Amiantis umbonella*** (N=1 440).

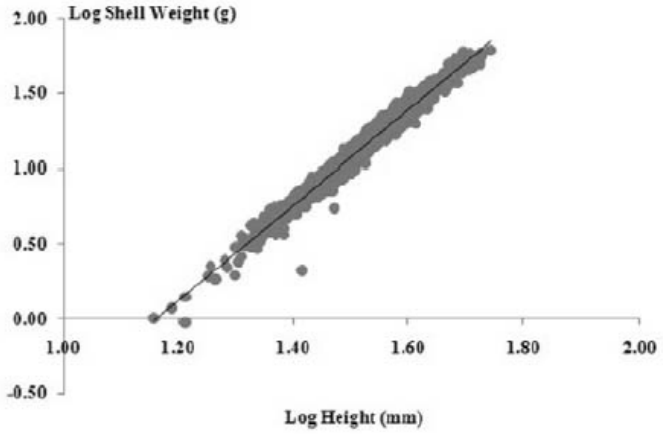

Fig. 9: Morphometric relationship between log Height and log shell weight of *Amiantis umbonella* (N=1440).

sediment [12], type of bottom [5] and wave exposure [1]. In the present study, sampling performed from Coasts with very low gradient, wide tidal zone with tidal pools and soft sediments in all parts. Therefore a suitable biological condition is provided for this bivalve. The results from the current study lead to three insights into the application of morphometric data in clam ***Amiantis umbonella.*** Firstly, measurements of shell length rather than shell height were consistently proportional to the weight (total, visceral mass and shell) during annual sampling. Secondly, the application of the morphometric relationship between the shell height and weight (total, visceral mass and shell) is the most useful relation for stock assessment and management of this species in environment. Thirdly, according to determined morphometric relationships, it would be suggested to use pocket net mariculture for suitable assessment and management of this species.

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