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Length-weight relationships of *Vimba vimba persa* in southern coasts of the Caspian Sea Guilan province- Iran

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ABSTRACT

Length weight relationships of *Vimba vimba persa* were studied. For this purpose 174 fish samples were collected by gill nets, beach seine and purse seine from March through June 2008 at two Guilan fisheries catch stations of Guilan located in Anzali- Kiyashahr regions. Samples were immediately transferred to the laboratory of fish biology at University of Guilan for further analyses. Length, weight and other external features of all samples were measured. Total Length and weight ranged from 140 to 220 mm and 24.7 to 97.6 gr respectively. Significant difference was observed among mean weight of fish in Anzali 48.01±9.33mm and Kiyashahr regions 51.25±19.9mm ($p<0.05$). Comparison of condition factor (CF) in fish Samples showed higher condition factor in fish from Kiyashahr region ($p<0.05$). Our results showed that growth pattern of *Vimba vimba* in Guilan with regard to their weight and length relationships is allometric (non- homogeneous) and negative which considering fishing pressure, pollution and deterioration of its stocks could be of special concern.

Key words: Length-weight, *Vimba vimba*, Condition factor, Caspian Sea, Allometric growth

INTRODUCTION

Study of fish in aquatic ecosystems concerning ecological and behavioral aspects, conservation and management of water resources and exploitation of fish stocks is important and essential**.** Estimates of age and growth of the stock assessment model has been the most important inputs for assessing the impacts of fishing on the population dynamics are used (Pitcher and Hart, 1982; Stevenson, 1997). Management decisions based on incorrect estimates of age and growth of fish stocks can lead to destructive exploitation (Beamish and Macfarlane, 1983). In fish, size is generally more biologically relevant than age, mainly because several ecological and physiological factors are more size- dependent than age-dependent. Therefore, length- weight regressions have been used frequently to estimate weight from length since direct weight measurements can be time-consuming in the field (Sinovcic et al. 2004).

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Study of Length-weight relationship and population dynamics is one of the fundamentals of applied ecology and population biology of fish stocks (King, 2007). Length-weight relationships are very useful for fisheries research since they let the estimation of biomass from length observations and also allow the transformation of growth- length equations to growth- weight for use in stock evaluation models. This relationships also allow evaluation of the fish condition and are useful for between- region comparisons of life histories of certain species (Goncalves *et al*. 1996, Froese and Pauly 1998, Moutopoulos and Stergiou 2000). *Vimba vimba persa* is a benthopelagic species living in river systems of the Caspian, Azov, Baltic and Black seas as well as in Western Europe (Robins *et al*., 1991; Bogutskaya, 1997; Riede, 2004). The species is near threatened in the southern Caspian Sea basin according to IUCN criteria (Kiabi *et al*., 1999). Objectives of the present study was to investigate growth, age and Length- weight relationship (LWR) of *Vimba vimba persa* in Anzali and kiyashahr regions in southern basins of the Caspian Sea.

MATERIALS AND METHODS

In this study 174 specimens of *V. vimba* were collected using gill nets, beach seine and encircling net from March through June 2008 at two Guilan fisheries catch stations in Anzali and Kiyashahr regions. Considering the fact that *Vimab vimba* stocks have been heavily exploited in the past, collecting the desired number of fish samples was the biggest challenge of the study. All collected samples were immediately placed in ice box and transported to the laboratory of fish biology at University of Guilan for further analyses and stored in a freezer to avoid subsequent deterioration. Prior to length and weight measurements fish samples were taken from freezer and allowed for gradual thawing. Samples were separated by sex. Scales were cleaned with 3% potassium hydroxide solution and used for age determinations. TL and SL were determined to the nearest cm and the body weight (gr) to the nearest 0.1 gr using digital balance and length-weight relationships were determined using the equation: $W = aL^b$ (Froese, 2006), where W = weight of the samples (g), L = length of the sample (cm), a & b= constant. Data are presented as mean ± standard error (Mean ± SD). Condition factor was calculated using the following formula $CF = 100*W/L^3$ (Pauly, 1983); where W= weight in grams; L= total length (cm). Normality of the date were tested by by Shapiro-Wilk normality test. ANOVA and TUKEY post hoc test were used to examine the significance of differences and comparison of catch station. All statistical analysis were conducted by SPSS version 16 and graphs were produced by Excel (2003).

RESULTS

A total of 174 of *Vimba vimba persa* samples used in this study were collected in Anzali region (n=96) and Kiyashahr region (n=78). Fish age varied in the range of 1-3 years. Age determination was based upon scale samples taken from upper parts of the lateral line and classified as shown in Table 1.

Table 1: Age classes of *Vimba vimba* from south-west Caspian Sea

Location	Age range	Absolute frequency	frequency %
Anzali	1	18	26.08
	2	31	32.29
	3	47	48.9
Kiyashahr	1	17	23.07
	2	27	35.89
	3	32	41.02

Mean weight of fish was 49.63±14.61gr, mean length was 154.07±14.08cm and FL was 168.47±14.79 cm. Majority of fish were sexually mature and male/female ratio was 1.3:1. The condition factor (CF) was 1.25±0.11 and 1.36±0.095 in Anzali and Kiyashahr respectively. There was significant differences in condition factor between fish from Anzali and Kiyashahr regions (p<0.05) (Figure 1).

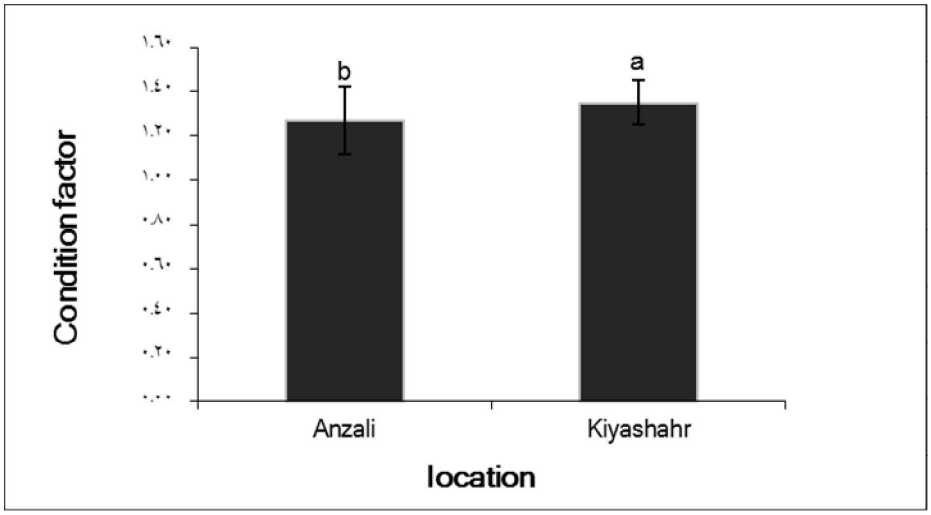

Figure 1. Condition factor of *Vimba vimba* in Anzali and Kiyashahr

Significant statistical difference was observed in body weight between fish collected in Anzali and Kiyashahr regions (p<0.05) table 2. The mean fish weight in Anzali and Kiyashahr regions were 48.01±9.33 and 51.25±19.9 gr respectively. Mean total length (TL) of fish in Anzali and Kiyashahr regions were 169.53±10.57 and 167.42±19.02 mm respectively. There was no significant differences in total and fork length of fish from two regions.

Table1: Biological data of examined fish specimens in south –west Caspian Sea (Guilan province)

Biological data	**Anzali (n=96)**	**Kiyashahr (n=78)**
Weight(gr)± SD	48/01±9/33[a]	51/25±19/9[b]
Fork Length(cm)± SD	155/1±10/1[a]	153/05±18/07[a]
Total Length(cm)± SD	169/53±10/57[a]	167/42±19/02[a]

The length-weight relationship was calculated by transforming the real data to the logarithmic by the following equation of log W = log a + b·log L. The value of log a in Anzali and Kiyashahr were -2.719 and -1.929 and r^2 equal to 0.914 and 0.951 and the obtained equations were $W= -2.719\ TL^{3.558}$, and $W= -1.929\ TL^{2.952}$ respectively. Figures 2 and 3 show the plot of logarithmic equation of *Vimba vimba* obtained in this study.

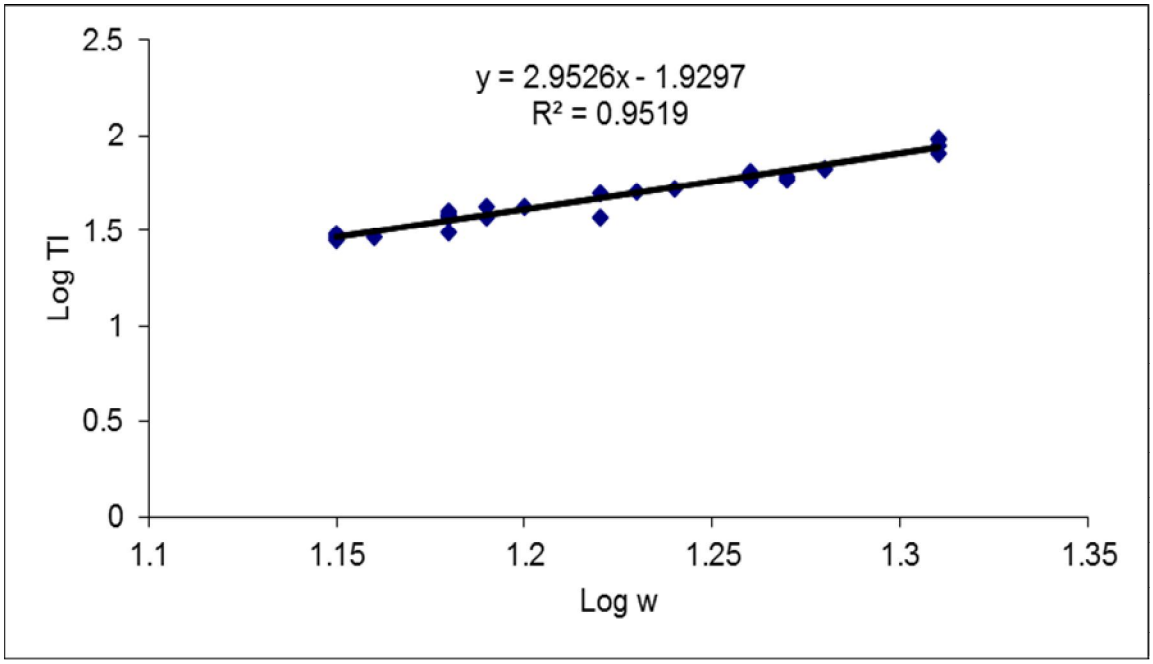

Figure 2: Length-weight relationship of *Vimba vimba* in Kiyashahr region- Caspian Sea

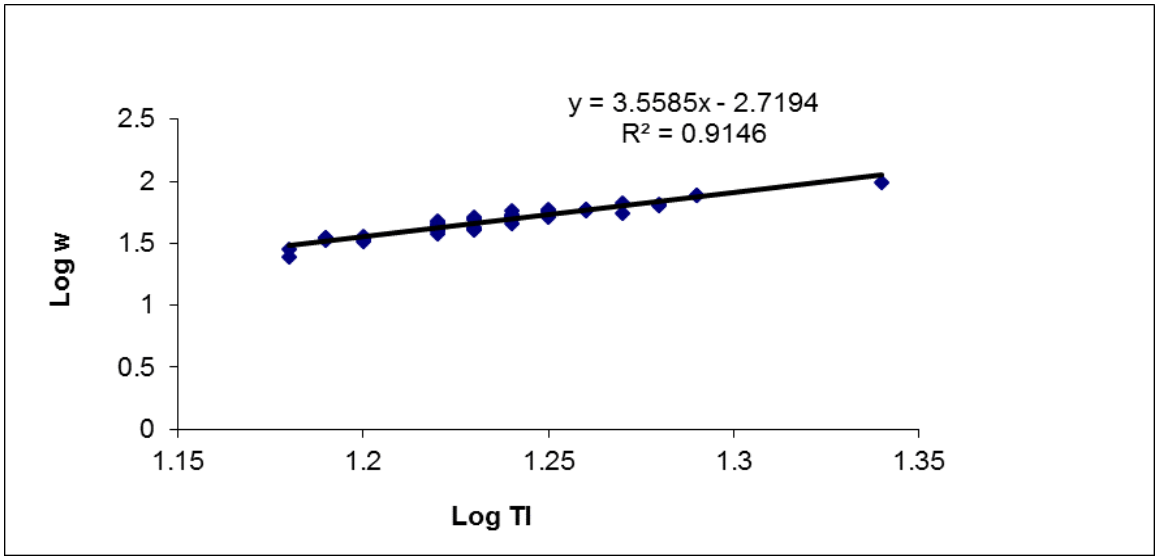

Figure 3: Length-weight relationship of *Vimba vimba* in Anzali region- Caspian Sea

DISCUSSION

In present study maximum length (TL) for *Vimba vimba* in Anzali and Kiyashahr regions were recorded as 220 and 206 mm respectively, while Tarkan *et al*. (2006) and Chaichi *et al.* (2011) reported 262 mm for *Vimba vimba* (Linnaeus, 1758) from Lake Sapanca in Turkey. The maximum weight in present study was 97.6 g in Anzali and 97.3 in Kiyashahr. In previuos studies in the Caspian region the maximum weight has been reported 148.7 g (Yektan *et al*., 2004) and 178.3 (Chaichi *et al*., 2011) for *Vimba vimba*.

Further away from the Caspian Sea Machacek (2006) has reported the maximum weight (233 gr) for *Vimba vimba* from Weser River in Germany. In general condition factor above 1 (CF> 1) represents better status of fish population in comparison to those with condition factor below (Cf< 1). In this study, condition factor was 1.35 in Kiyashahr and 1.27 in Anzali which are indications of good growth of *Vimba vimba* in these areas. Xiao and Ramm (1994) suggested that the use of log-transformed data was appropriate for describing length-weight relationships in fish. Our choice of an allometric model was practical. linear regression using log-log transformed data facilitated statistical comparisons of length-weight relationships. The results of the length and weight relationship between fish specimens shows that there is a strong correlation between length and weight of *Vimba vimba* from Kiashahr and Anzali which allows to calculate the length or weight using the linear relationship between weight and length as explained in Bagenal (1978). Abbasi *et al* (2004) stressed that that the parameters of the length-weight relationship (a, b) are very important in fish stock assessment studies. Moreover the length - weight relationship could be utilized to determine the status of fish growth. The regression coefficient (b) is usually between 2 and 4 in fish (Bagenal, 1978). The 'b' value above 3 indicates that fish become wider or deeper as they grow while an exponent below 3 indicates they become more slender. The values of the exponent b in this study were higher than 3.0 for fish collected in Anzali region thus exhibiting a positive allometric growth for *Vimba vimba* in Anzali region while these figures for fish collected in Kiyashahr regions were lower than 3.0 reflecting a negative allometric growth. Although variations in b values depend firstly on the shape and fatness of the fish, various factors may be responsible for differences in parameters of the length-weight relationships in different seasons and years, such as salinity, temperature, fish health, sex, the number of examined specimens, differences in sampling methods, stage of maturity, length range of the species, stomach fullness, food and time of year (Tesch, 1971; Pauly, 1984; Sparre, 1992; Momsen, 1998; Treer *et al*., 1998, 1999; Morey *et al*., 2003). Analyzing length-weight relationships showed that the growth pattern of *Vimba vimba* in Guilan is allometric (non- homogeneous) negative in Kiyashahr region which could be due to huge fishing pressure and increasing pollution load in the Caspian Sea. According to Weis, (2009) pollution could be effective on biological aspects of fish such as growth rate (length - weight relationship) and feeding and reproductive behavior. These parameters are essential for evaluating the relative condition of fish and species managements as well as their fisheries and stock assessment in the Caspian Sea.

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