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# Length-Weight Relationship and Condition Factor of *Hippocampus hippocampus* and *Hippocampus guttulatus* Inhabiting Eastern Black Sea

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**Abstract.-** In this study, length–weight relationships of two seahorse species were determined inhabiting Eastern Black Sea. *Hippocampus hippocampus* (38) and *Hippocampus guttulatus* (139) individuals were obtained by commercial fishermen in the Eastern Black Sea. Length-weight relationships of *H. hippocampus* were found as $W=0.012TL^{2.41}$ ($R^2=0.90$) and length-weight relationships of *H. guttulatus* were found as $W=0.005TL^{2.84}$ ($R^2=0.91$) for all individuals. The type of growth for both sexes was negative allometric growth ($b<3$) for these species. Average condition factors of *H. hippocampus* and *H. guttulatus* have shown 0.38 and 0.41, respectively.

**Key Words:** *Hippocampus hippocampus*, *Hippocampus guttulatus*, length-weight relationship, condition factor, Eastern Black Sea.

## INTRODUCTION

The genus *Hippocampus* is represented by two species as *Hippocampus hippocampus* (short-snouted sea horse) and *H. guttulatus* (long-snouted sea horse) in Mediterranean and Black Sea (Golani *et al*., 2006). The major continuing threat to *H. hippocampus* is assumed to be similar to that for *H. guttulatus*, which is habitat degradation and disturbance through direct anthropogenic activities such as coastal developments and the effect of fishing gear. Habitat degradation through climate change continues across *H. hippocampus* geographic range and, like other small coastal fish *H. hippocampus* is also threatened by pollution from shore side run-off and ships (Islam and Tanaka, 2004).

Length–weight relationships for fish have been used extensively to provide information on the condition of fish, their isometric or allometric growth, in the analysis of ontogenic changes, to compare life histories of fish species between regions as well as other aspects of fish population dynamics. In fisheries biology, length–weight relationships are useful for the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models and to estimate stock biomass from limited sample sizes (Binohlan and Pauly, 1998; Can *et al*., 2002; Koutrakis and Tsikliras, 2003; Valle *et al*., 2003; Ecoutin *et al*., 2005; Başusta and Cicek, 2006; Gürkan and Taşkavak, 2007; Başusta *et al*., 2012, 2013a,b).

This study is to determine the length-weight relationships (LWRs) and condition factor of *H. hippocampus* and *H. guttulatus* from the Eastern Black Sea.

## MATERIALS AND METHODS

A total of 177 sea horses (Fig. 1), 38 *H. hippocampus* and 139 *H. guttulatus* were collected as by-catch from the small-scale fishermen in 2011-2012 fishing season in the Eastern Black Sea (Fig. 2). The specimens were identified according to Golani *et al*. (2006). They were measured to the nearest 0.1 cm in total length and the nearest 0.1 g in weight.

Length-weight relationship for total body weight was calculated using the equation $W= a. L^b$, where W is weight (expressed in grams), L is length (TL), *a* is the intercept, and *b* is the slope. The degree of association between the variables was computed by the determination coefficient, $R^2$. The parameters *a* and *b* were estimated by linear regression on the Log-transformed equation *log*

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*(W)=log (a)+ b log (L)*. In the length-weight equation *a* and *b* are intercept and the slope of the length-weight curve, respectively.


Fig. 1. General appearance of *Hippocampus hippocampus* (A) and *Hippocampus guttulatus* (B)

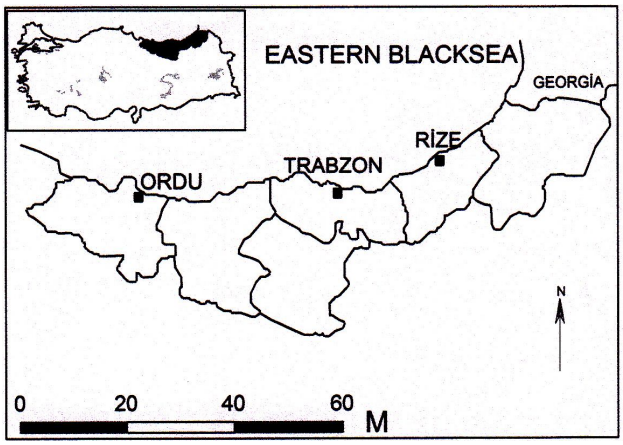


Fig. 2. Sampling area in the eastern Black Sea.

Condition factor (K) was calculated using the equation; $K= (W / L^3) \times 100$. The parameters LWR were estimated by linear regression on the transformed equation log W=log a+b log TL. Length-weight relationship for female, male and all individuals have been identified separately. Student t-test was used to determine whether the difference between length and weight are significant. Microsoft Excel 2007 (Microsoft Corporation) program was used to the statistical evaluation of data.

## RESULTS AND DISCUSSION

A total of 177 individuals of sea horse, (38 for *H. hippocampus* and 139 for *H. guttulatus*) were collected during the study (Table I). Total length and weight of samples ranged between 6.39-9.41cm and 1.062-2.9 g for *H. hippocampus* and between 5.78-9.0 cm and 0.85-2.96 g for *H. guttulatus*, respectively. The estimated parameters of the length-weight relationships and length characteristics (number of fish (n), size range and weight range), the coefficient of determination ($R^2$) and type of growth are given in Table I.

The length-weight relations were separately estimated for females and males, are presented in Figures 3, 4. Length-weight relationships of *H. hippocampus* were found as $W=0.0128TL^{2.4121}$ ($R^2=0.905$) for all specimens, $W=0.0163TL^{2.2869}$ ($R^2=0.900$) for females and $W=0.0112TL^{2.4811}$ ($R^2=0.876$) for males. Length-weight relationships of *H. guttulatus* were found as $W=0.0057TL^{2.8475}$ ($R^2=0.911$) for all specimens, $W=0.0085TL^{2.646}$ ($R^2=0.891$) for females, $W=0.0044TL^{2.977}$ ($R^2=0.920$) for males, respectively.

The condition factor values varied between 0.3317-0.4664 (average 0.3837) in *H. hippocampus* and 0.3537-0.5094 (average 0.4183) in *H. guttulatus*. *b*-value has been identified as 2.2869, 2.4811, 2.4121 for all individuals, males and females of *H. hippocampus*, respectively. *b*-value has been identified as 2.646, 2.977, 2.8475 for all individuals, males and females in *H. guttulatus*, respectively. The type of growth for both sexes was negative allometric growth ($b<3$) for *H. hippocampus* and *H. guttulatus*. The difference of length-weight relationship between two species was statistically insignificant ($P>0.05$).

Length ranges given by Gurkan and Taşkavak (2007), for *H. hippocampus* and *H. guttulatus* were 8-14 cm and 10-16.5 cm, respectively, while they varied 6.39-9.41 and 5.78-9.00 cm in this study (Eastern Black Sea). The values of the scaling exponent *b* for two seahorses (Table I) ranged from

**Table I.- Length–weight relationship of *Hippocampus hippocampus* and *Hippocampus guttulatus*, Eastern Black Sea, Turkey. Sample size, total length (TL), weight (W) and equation parameters for *a* and *b*, and $R^2$ values (n= sample size; *a*, intercept of the regression; *b*, slope or regression coefficient; $R^2$ coefficient of determination).**

| Species | Sex | N | Size range (cm) | Weight range (g) | *a* | *b* | $R^2$ | References |
|---|---|---|---|---|---|---|---|---|
| *H. hippocampus* | M | 18 | 6.9-9.4 | 1.50-2.9 | 0.011 | 2.48±0.006 | 0.87 | In this study |
| | F | 20 | 6.3-8.2 | 1.06-2.2 | 0.016 | 2.28±0.006 | 0.90 | |
| *H. guttulatus* | M | 79 | 6.3-9.0 | 1.06-2.9 | 0.004 | 2.97±0.003 | 0.92 | In this study |
| | F | 59 | 5.7-8.6 | 0.85-2.6 | 0.008 | 2.64±0.004 | 0.89 | |
| *H. hippocampus* | All | 29 | 8-14 | 0.95-6.5 | 0.001 | 3.14 | 0.76 | Gürkan and Taşkavak (2007) |
| *H. guttulatus* | All | 200 | 10-16.5 | 2.54-11.8 | 0.010 | 2.47 | 0.64 | Gürkan and Taşkavak (2007) |
| *H. hippocampus* | All | 163 | 2.7-13.7 | 1.11-4.68 | 0.004 | 2.94 | 0.56 | Ak *et al*. (2009) |
| *H. guttulatus* | All | 84 | 3.6-18.5 | - | 0.007 | 2.71 | 0.99 | Veiga *et al*. (2009) |
| *H. hippocampus* | All | 9 | 4.5-13.7 | - | 0.006 | 2.73 | 0.95 | Veiga *et al*. (2009) |

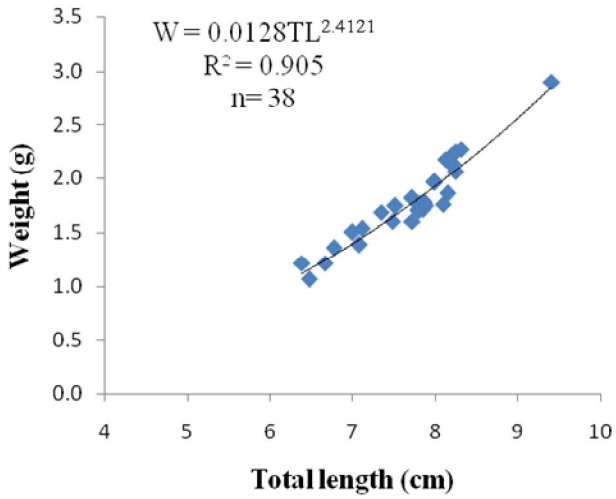


Fig. 3. Length–weight relationships of *Hippocampus hippocampus* for all individuals.

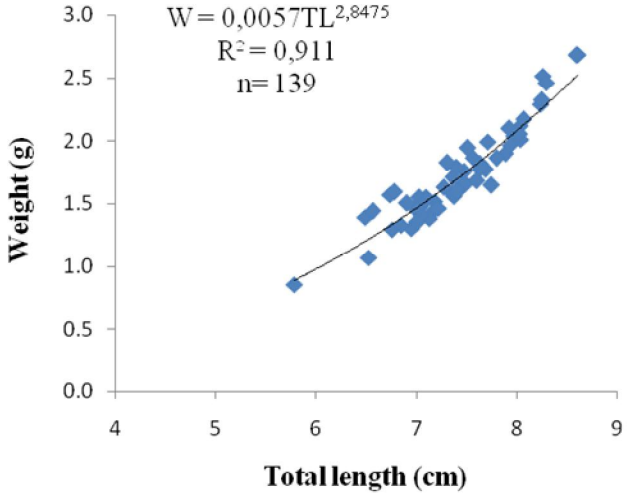


Fig. 4. Length–weight relationships of *Hippocampus guttulatus* for all individual

2.28-2.97 and our results remained within the ranges gives. Gurkan and Taşkavak (2007) reported values of the scaling exponent *b* for seahorses 2.47-3.14 in Aegean Sea. However, Eastern Black Sea seahorse species are listed as data deficient (DD) indicating that more information is required (IUCN).

The high values of $R^2$ indicate that future research may show that another classification is appropriate making data on seahorses in general of great importance.

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