

Technical contribution

Length–weight relationships for six fish species in Iskenderun Bay (Eastern Mediterranean Sea coast of Turkey)

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Summary

The length–weight relationships (LWRs) were estimated for six non-indigenous fish species, namely, *Apogon smithi* (Kottaus, 1970); *Ostorhinchus fasciatus* (White, 1790); *Pomadasys stridens* (Forsskal, 1775); *Champsodon capensis* Regan, 1908; *Torquigener flavimaculosus* Hardy & Randall, 1983; and *Tylerius spinosissimus* (Regan, 1908) from Iskenderun Bay, eastern Mediterranean Sea. Their length–weight relationship b values ranged from 2.902 to 3.501, and all regressions were found to be significant for all six species ($P < 0.001$). This study is the first reference on length–weight relationships for these six non-indigenous fish species from the Eastern Mediterranean Sea coast of Turkey.

Introduction

Since the opening of the Suez Canal many alien fish species have crossed into the Mediterranean Sea and established dense populations on the eastern coastal areas of Turkey (Erguden and Turan, 2013). Some species have become important in the composition of the Eastern Mediterranean ichthyofauna and also acquiring economic importance within the regional fisheries (Bariche et al., 2004).

In recent years, six non-indigenous fish species have succeeded in finding a niche on the Eastern Mediterranean coast of Turkey, in Iskenderun Bay (Erguden and Turan, 2013), and are now included in the ichthyofauna of Turkey (Bilecenoglu et al., 2014; Erguden et al., 2014). The evaluation of length–weight data for these species has not yet been added to the records in FishBase (Froese and Pauly, 2014).

Length–weight relationships (LWRs) allow fisheries scientists to convert growth-in-length equations to growth-in-weight in stock assessment models (Morato et al., 2001; Stergiou and Moutopoulos, 2001), to estimate biomass from the length-frequency distribution (Petrakis and Stergiou, 1995; Dulčić and Kraljević, 1996; Erguden et al., 2009), as well as to calculate the condition of the fish (Petrakis and Stergiou, 1995).

The present study shows the first-time results of an investigation of length–weight relationships of six non-indigenous fish species: *Apogon smithi* (Kottaus, 1970); *Ostorhinchus*

fasciatus (White, 1790); *Pomadasys stridens* (Forsskal, 1775); *Champsodon capensis* Regan, 1908; *Torquigener flavimaculosus* Hardy & Randall, 1983; and *Tylerius spinosissimus* (Regan, 1908) from the eastern Mediterranean Sea coast of Turkey.

Materials and methods

The Bay of Iskenderun (36°04'–36°32'N, 35°56'–35°50'E) located along the north-eastern Levantine Basin in the south-eastern part of Turkey is one of the most important harbor and fishing areas in the eastern Mediterranean Sea. The bay is 65 km long and 35 km wide with an average depth of 70 m, and covers an area of approximately 2275 km² (Iyidivar, 1986).

Six non-indigenous fish species were collected during commercial bottom trawling between September 2011 and June 2012 from four locations: Samandag, Ulucinar, Yumurtalik, and Karataş. The samples were transported to the laboratory in polythene bags containing ice blocks to prevent spoilage and then deep frozen (–30°C) to prevent deterioration. Species identification was carried out according to Golani et al. (2002). The scientific name for each species was checked against FishBase (Froese and Pauly, 2014).

Total length (TL) of each specimen was measured using a digital caliber to 0.1 cm accuracy, and body weight determined with a digital balance to an accuracy of 0.01 g. The statistical relationship between length (L) and weight (W) of the fish was calculated using the equation of Le Cren (1951) as: $W = a \cdot L^b$, where a and b are constants. This equation was further converted into its logarithmic expression as $\ln W = \ln a + b \ln L$. The parameters a and b were calculated using least-squares regression as the coefficient of determination (r^2). Values of the exponent b provide information indicating the type of growth when the isometric growth b is 3.0. A higher value ($b > 3.0$) represents positive allometric growth; a lower value ($b < 3.0$) shows a negative allometric growth. The b value for each species was tested using a t -test at the 0.001 significance level, to verify if significantly different from 3. Outliers were excluded in the regression analyses. All statistical analyses were performed using SPSS v. 19.0.

Table 1
Descriptive statistics and length–weight relationships (LWRs) for six non-indigenous fish species, eastern Mediterranean coast of Turkey

Species	Length (TL,cm)			Weight (g)		Relationship parameters				
	n	L _{min}	L _{max}	W _{min}	W _{max}	a	b	SE of b	95%CI of b	r ²
<i>Apogon smithi</i> (Kotthaus, 1970)	116	6.3	14.0	2.2	43.8	0.0044	3.501	0.047	3.407–3.595	0.980
<i>Ostorhinchus fasciatus</i> (White, 1790)	230	4.8	12.6	1.8	32.4	0.0133	3.118	0.038	3.044–3.193	0.968
<i>Pomadasys stridens</i> (Forsskal, 1775)	335	7.6	17.7	5.5	77.8	0.0049	3.406	0.039	3.329–3.483	0.958
<i>Champsodon capensis</i> Regan, 1908	426	6.0	14.2	2.1	26.3	0.0079	3.020	0.025	2.972–3.069	0.972
<i>Torquigener flavimaculosus</i> Hardy & Randall, 1983	11	4.8	11.6	3.1	39.8	0.0403	2.902	0.170	2.517–3.287	0.970
<i>Tylerius spinosissimus</i> Regan, 1908	6	1.7	2.2	0.8	1.9	0.0133	3.425	0.274	2.663–4.186	0.975

n, sample size; Min, minimum; Max, maximum; *a* and *b*, parameters of the LWR; CI, confidence interval; *r*², coefficient of determination.

Results

Lengths (TL) and weights (g) of a total of 1124 fish were measured, recorded and analyzed for the six non-indigenous fish species. Calculated parameters and length characteristics of the length–weight relationships are given in Table 1. The *b* values ranged from 2.902 to 3.501. All regression values were found to be highly significant ($P < 0.001$), with the coefficient of determination (*r*²) values being >0.95 for all six fish species (Table 1).

Discussion

Since the length and weight data does not represent a seasonal sampling, the calculated parameters *a* and *b* should be considered as mean annual values. Although several factors including gonad maturity, stomach fullness, season, health and preservation techniques influence the LWRs in fish (Bagenal and Tesch, 1978), none of the effects of these factors were taken into account directly.

In recent years, non-indigenous fish species have dispersed rapidly throughout the eastern Mediterranean Sea; however, there has been no LWR information for six of these non-indigenous species present in the coastal region of the Turkish area of the Mediterranean. The LWRs provided in this paper include valuable information useful to fisheries biologists and managers as well as for the Fish-Base database.

This research is the first reference on length–weight relationships for six non-indigenous species from the Eastern Mediterranean coast of Turkey, Iskenderun Bay.

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