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WEIGHT–LENGTH RELATIONS FOR 103 FISH SPECIES FROM THE SOUTHERN AEGEAN SEA, TURKEY

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Abstract. Using a traditional, commercial, crustacean bottom trawl net we collected fish samples from the southern Aegean Sea, from Dec 2009 to Nov 2010, at depths of 30–225 m. We collected a total of 35 428 specimens representing 50 families and 103 species: *Argentina sphyraena* Linnaeus, 1758; *Arnoglossus laterna* (Walbaum, 1792); *Arnoglossus rueppelii* (Cocco, 1844); *Arnoglossus thori* Kyle, 1913; *Belone belone* (Linnaeus, 1761); *Belone svetovidovi* Collette et Parin, 1970; *Blennius ocellaris* Linnaeus, 1758; *Boops boops* (Linnaeus, 1758); *Bothus podas* (Delaroche, 1809); *Buglossidium luteum* (Risso, 1810); *Callionymus lyra* Linnaeus, 1758; *Callionymus risso* Lesueur, 1814; *Capros aper* (Linnaeus, 1758); *Cepola macrophthalma* (Linnaeus, 1758); *Chelidonichthys cuculus* (Linnaeus, 1758); *Chelidonichthys lucerne* (Linnaeus, 1758); *Chlorophthalmus agassizi* Bonaparte, 1840; *Chromis chromis* (Linnaeus, 1758); *Citharus linguatula* (Linnaeus, 1758); *Coelorinchus caelorhincus* (Risso, 1810); *Conger conger* (Linnaeus, 1758); *Coris julis* (Linnaeus, 1758); *Dentex dentex* (Linnaeus, 1758); *Diplodus annularis* (Linnaeus, 1758); *Diplodus sargus sargus* (Linnaeus, 1758); *Diplodus vulgaris* (Geoffroy Saint-Hilaire, 1817); *Echelus myrus* (Linnaeus, 1758); *Equulites klunzingeri* (Steindachner, 1898); *Eutrigla gurnardus* (Linnaeus, 1758); *Fistularia commersonii* Rüppell, 1838; *Gadiculus argenteus* Guichenot, 1850; *Glossanodon leioglossus* (Valenciennes, 1848); *Gobius cruentatus* Gmelin, 1789; *Gobius niger* Linnaeus, 1758; *Helicolenus dactylopterus* (Delaroche, 1809); *Hoplostethus mediterraneus* Cuvier, 1829; *Labrus merula* Linnaeus, 1758; *Labrus viridis* Linnaeus, 1758; *Lampanyctus crocodilus* (Risso, 1810); *Lepidorhombus boscii* (Risso, 1810); *Lepidorhombus whiffiagonis* (Walbaum, 1792); *Lepidotrigla cavillone* (Lacepède, 1801); *Lepidotrigla dieuzeidei* Blanc et Hureau, 1973; *Lesueurigobius friesii* (Malm, 1874); *Lithognathus mormyrus* (Linnaeus, 1758); *Liza ramada* (Risso, 1827); *Lophius budegassa* Spinola, 1807; *Lophius piscatorius* Linnaeus, 1758; *Macroramphosus scolopax* (Linnaeus, 1758); *Merluccius merluccius* (Linnaeus, 1758); *Mullus barbatus barbatus* Linnaeus, 1758; *Mullus surmuletus* Linnaeus, 1758; *Mustelus mustelus* (Linnaeus, 1758); *Mustelus punctulatus* Risso, 1827; *Nemipterus randalli* Russell, 1986; *Oblada melanura* (Linnaeus, 1758); *Pagellus acarne* (Risso, 1827); *Pagellus bogaraveo* (Brünnich, 1768); *Pagellus erythrinus* (Linnaeus, 1758); *Parablennius tentacularis* (Brünnich, 1768); *Peristedion cataphractum* (Linnaeus, 1758); *Pomadasys incisus* (Bowdich, 1825); *Pomatoschistus minutus* (Pallas, 1770); *Raja miraletus* Linnaeus, 1758; *Raja radula* Delaroche, 1809; *Salaria pavo* (Risso, 1810); *Saurida undosquamis* (Richardson, 1848); *Sciaena umbra* Linnaeus, 1758; *Scomber japonicas* Houttuyn, 1782; *Scophthalmus rhombus* (Linnaeus, 1758); *Scorpaena notata* Rafinesque, 1810; *Scorpaena porcus* Linnaeus, 1758; *Scorpaena scrofa* Linnaeus, 1758; *Scyliorhinus canicula* (Linnaeus, 1758); *Scyliorhinus stellaris* (Linnaeus, 1758); *Serranus cabrilla* (Linnaeus, 1758); *Serranus hepatus* (Linnaeus, 1758); *Serranus scriba* (Linnaeus, 1758); *Solea solea* (Linnaeus, 1758); *Sphyraena chrysotaenia* Klunzinger, 1884; *Spicara maena* (Linnaeus, 1758); *Spondyliosoma cantharus* (Linnaeus, 1758); *Squalus blainvillei* (Risso, 1827); *Symphodus cinereus* (Bonnaterre, 1788); *Symphodus doderleini* Jordan, 1890; *Symphodus mediterraneus* (Linnaeus, 1758); *Symphodus melanocercus* (Risso, 1810); *Symphodus ocellatus* (Linnaeus, 1758); *Symphodus rostratus* (Bloch, 1791); *Symphodus tinca* (Linnaeus, 1758); *Syngnathus acus* Linnaeus, 1758; *Torpedo marmorata* Risso, 1810; *Torpedo nobiliana* Bonaparte, 1835; *Trachinus draco* Linnaeus, 1758; *Trachurus mediterraneus* (Steindachner, 1868); *Trachurus picturatus* (Bowdich, 1825); *Trachurus trachurus* (Linnaeus, 1758); *Trigla lyra* Linnaeus, 1758; *Trigloporus lastoviza* (Bonnaterre, 1788); *Upeneus moluccensis* (Bleeker, 1855); *Upeneus pori* Ben-Tuvia et Golani, 1989; *Uranoscopus scaber* Linnaeus, 1758; *Zeus faber* Linnaeus, 1758. We estimated weight–length relations for the fishes collected. Values of the allometric coefficient (b) ranged from 2.1729 for *Cepola macrophthalma* to 3.6372 for *Equulites klunzingeri*.

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All relations were highly significant ($P < 0.001$), with the majority (94.17% of 103 species) r^2 values being greater than 0.9. Four species evidenced isometric growth, 50 species showed positive allometry, and 49 species have negative allometry. Seven species studied were Lessepsian migrants.

Keywords: WLR, marine fishes, Mediterranean Sea

Fisheries management and research often require the use of biometric relations in order to transform data collected in the field into appropriate indexes (Anderson and Gutreuter 1983, Écoutin and Albaret 2003, Mendes et al. 2004). In the fisheries science, weight–length relations (WLRs) have a several uses. They allow to:

• estimate weight from length for individual fish and for length classes of fish;

• estimate standing-crop biomass when the length frequency distribution is known (Anderson and Gutreuter 1983, Petrakis and Stergiou 1995);

• convert growth-in-length equations to growth-in-weight for prediction of weight-at-age and use in stock assessment models (Pauly 1993);

• calculate condition indices (Anderson and Gutreuter 1983, Petrakis and Stergiou 1995); and

• compare populations from different regions in terms of their life histories and morphology (Petrakis and Stergiou 1995).

Previous studies were carried out on the characterization of WLRs for fish species (numbers of the species within the parenthesis) in the Turkish coasts of the Aegean Sea: Akyol et al. (2007) (25), Ceyhan et al. (2009) (17), Filiz and Bilge (2004) (24), Gurkan et al. (2010) (22), İlkyaz et al. (2008) (62), Ismen et al. (2007) (63), Karakulak et al. (2006) (47), Özaydın et al. (2007) (60) and Özaydin and Taskavak (2006) (47). In the presently reported study, WLRs were estimated for 103 fish species captured off the Turkish coasts of the southern Aegean Sea.

From December 2009 to November 2010 we sampled southern Aegean Sea fishes from a total of 68 hauls taken by a crustacean trawl vessel F/V AKYARLAR from the depths of 30–225 m. The vessel used a traditional bottom trawl net (44 mm stretched mesh size), locally called "Ottoman net". The towing time was 30 min, at the speed of approximately 2.5 knots. The collected fish specimens were identified on board and then stored on ice until returned to the laboratory. In the laboratory, each fish was measured for total length (TL) to the nearest 0.1 cm and weighed (wet weight, W) to the nearest 0.01 g. Fish species were identified based on Whitehead et al. (1986) and validated following FishBase (Froese and Pauly 2013). The relation between weight and length,

$$W = aL^b$$

was converted into the logarithmic expression:

$$\ln W = \ln a + b \ln L$$

Parameters a and b were calculated by least-squares regression, as was the coefficient of determination (r^2). Significant difference of b values from 3, which represent isometric growth, was tested with the t-test (Pauly 1993).

We sampled a total of 35 428 fish specimens representing 50 families and 103 species (Table 1): *Argentina sphyraena* Linnaeus, 1758; *Arnoglossus laterna* (Walbaum, 1792); *Arnoglossus rueppelii* (Cocco, 1844); *Arnoglossus thori* Kyle, 1913; *Belone belone* (Linnaeus, 1761); *Belone svetovidovi* Collette et Parin, 1970; *Blennius ocellaris* Linnaeus, 1758; *Boops boops* (Linnaeus, 1758); *Bothus podas* (Delaroche, 1809); *Buglossidium luteum* (Risso, 1810); *Callionymus lyra* Linnaeus, 1758; *Callionymus risso* Lesueur, 1814; *Capros aper* (Linnaeus, 1758); *Cepola macrophthalma* (Linnaeus, 1758); *Chelidonichthys cuculus* (Linnaeus, 1758); *Chelidonichthys lucerne* (Linnaeus, 1758); *Chlorophthalmus agassizi* Bonaparte, 1840; *Chromis chromis* (Linnaeus, 1758); *Citharus linguatula* (Linnaeus, 1758); *Coelorinchus caelorhincus* (Risso, 1810); *Conger conger* (Linnaeus, 1758); *Coris julis* (Linnaeus, 1758); *Dentex dentex* (Linnaeus, 1758); *Diplodus annularis* (Linnaeus, 1758); *Diplodus sargus sargus* (Linnaeus, 1758); *Diplodus vulgaris* (Geoffroy Saint-Hilaire, 1817); *Echelus myrus* (Linnaeus, 1758); *Equulites klunzingeri* (Steindachner, 1898); *Eutrigla gurnardus* (Linnaeus, 1758); *Fistularia commersonii* Rüppell, 1838; *Gadiculus argenteus* Guichenot, 1850; *Glossanodon leioglossus* (Valenciennes, 1848); *Gobius cruentatus* Gmelin, 1789; *Gobius niger* Linnaeus, 1758; *Helicolenus dactylopterus* (Delaroche, 1809); *Hoplostethus mediterraneus* Cuvier, 1829; *Labrus merula* Linnaeus, 1758; *Labrus viridis* Linnaeus, 1758; *Lampanyctus crocodilus* (Risso, 1810); *Lepidorhombus boscii* (Risso, 1810); *Lepidorhombus whiffiagonis* (Walbaum, 1792); *Lepidotrigla cavillone* (Lacepède, 1801); *Lepidotrigla dieuzeidei* Blanc et Hureau, 1973; *Lesueurigobius friesii* (Malm, 1874); *Lithognathus mormyrus* (Linnaeus, 1758); *Liza ramada* (Risso, 1827); *Lophius budegassa* Spinola, 1807; *Lophius piscatorius* Linnaeus, 1758; *Macroramphosus scolopax* (Linnaeus, 1758); *Merluccius merluccius* (Linnaeus, 1758); *Mullus barbatus barbatus* Linnaeus, 1758; *Mullus surmuletus* Linnaeus, 1758; *Mustelus mustelus* (Linnaeus, 1758); *Mustelus punctulatus* Risso, 1827; *Nemipterus randalli* Russell, 1986; *Oblada melanura* (Linnaeus, 1758); *Pagellus acarne* (Risso, 1827); *Pagellus bogaraveo* (Brünnich, 1768); *Pagellus erythrinus* (Linnaeus, 1758); *Parablennius tentacularis* (Brünnich, 1768); *Peristedion cataphractum* (Linnaeus, 1758); *Pomadasys incisus* (Bowdich, 1825); *Pomatoschistus minutus* (Pallas, 1770); *Raja miraletus* Linnaeus, 1758; *Raja radula* Delaroche, 1809; *Salaria pavo* (Risso, 1810); *Saurida undosquamis* (Richardson, 1848); *Sciaena umbra* Linnaeus, 1758; *Scomber japonicas* Houttuyn, 1782; *Scophthalmus rhombus* (Linnaeus, 1758); *Scorpaena notata* Rafinesque, 1810; *Scorpaena porcus* Linnaeus, 1758; *Scorpaena scrofa* Linnaeus, 1758; *Scyliorhinus canicula* (Linnaeus, 1758); *Scyliorhinus stellaris* (Linnaeus, 1758); *Serranus*

Table 1

Weight–length relations for 103 fish species from Turkish coasts of the southern Aegean Sea

No.	Species	Origin	N	L_{min}	L_{max}	Relation parameters					Growth type
						a	b	SE of b	r^2	95% CI of b	
1	*Argentina sphyraena*	AM	516	7.0	16.6	0.0034	3.4750	0.0260	0.960	3.3588–3.5399	A+
2	*Arnoglossus laterna*	AM	1305	4.5	14.9	0.0092	2.9295	0.0193	0.946	2.8916–2.9673	A–
3	*Arnoglossus rueppelii*	AM	126	4.7	11.9	0.0037	3.1790	0.0942	0.987	2.9848–3.3732	A+
4	*Arnoglossus thori*	AM	121	6.8	9.9	0.0328	2.3921	0.1097	0.969	2.1464–2.6378	A–
5	*Belone belone*	AM	44	27.8	54.5	0.0003	3.3953	0.0982	0.958	3.1837–3.6069	A+
6	*Belone svetovidovi*	AM	36	28.2	41.8	0.0007	3.1173	0.1225	0.830	3.0025–3.2321	A+
7	*Blennius ocellaris*	AM	35	7.5	15.3	0.0147	2.9964	0.1182	0.951	2.7558–3.2369	A–
8	*Boops boops*	AM	68	9.4	24.4	0.0197	2.8269	0.1119	0.906	2.6032–3.0504	A+
9	*Bothus podas*	AM	84	10.7	20.1	0.0041	3.3728	0.1274	0.986	3.0943–3.6513	A+
10	*Buglossidium luteum*	AM	93	6.6	11.7	0.0125	2.8946	0.0938	0.878	2.7088–3.0803	A–
11	*Callionymus lyra*	AM	47	19.1	27.7	0.0112	2.8247	0.0186	0.985	2.2733–3.3761	A–
12	*Callionymus risso*	E	43	3.5	7.4	0.0082	2.8435	0.2342	0.931	2.0503–3.6367	A–
13	*Capros aper*	AM	602	2.9	9.7	0.0353	2.6360	0.0410	0.880	2.5550–2.7173	A–
14	*Cepola macrophthalma*	AM	988	7.5	51.0	0.0126	2.1729	0.0184	0.933	2.1367–2.2095	A–
15	*Chelidonichthys cuculus*	AM	51	13.7	16.5	0.0178	2.7151	0.8234	0.937	2.6416–2.7886	A–
16	*Chelidonichthys lucerna*	AM	81	16.6	40.7	0.0052	3.2225	0.0541	0.976	3.1148–3.3300	A+
17	*Chlorophthalmus agassizi*	AM	889	5.0	18.7	0.0033	3.2840	0.0220	0.960	3.3883–3.4542	A+
18	*Chromis chromis*	AM	57	6.7	11.6	0.0147	3.0513	0.1241	0.962	2.7998–3.3028	A+
19	*Citharus linguatula*	AM	1366	8.2	26.4	0.0058	3.0911	0.0161	0.957	3.0593–3.1227	A+
20	*Coelorinchus caelorhincus*	AM	117	6.0	10.9	0.0067	2.6975	0.6032	0.910	2.6169–2.7781	A–
21	*Conger conger*	AM	72	25.8	51.7	0.0002	3.5482	0.1118	0.981	3.2820–3.8145	A+
22	*Coris julis*	AM	201	6.2	13.6	0.0068	3.1178	0.0311	0.982	3.0563–3.1792	A+
23	*Dentex dentex*	AM	97	13.7	32.9	0.0157	3.0185	0.1925	0.958	2.6164–3.4206	A+
24	*Diplodus annularis*	AM	2554	5.3	16.3	0.0192	3.0425	0.0186	0.912	3.0058–3.0790	A+
25	*Diplodus sargus sargus*	E	83	11.7	27.3	0.0205	2.9682	0.2819	0.947	2.7164–3.2200	A–
26	*Diplodus vulgaris*	AM	1893	5.5	23.1	0.0309	2.8940	0.0135	0.965	2.8730–2.9206	A–
27	*Echelus myrus*	AM	57	39.7	72.6	0.0029	2.6472	0.1331	0.989	2.3001–2.9943	A–
28	*Equulites klunzingeri*	L	71	6.3	9.8	0.0121	3.6372	0.0402	0.927	3.4554–3.8190	A+
29	*Eutrigla gurnardus*	AM	118	10.7	21.3	0.0036	3.2625	0.1119	0.981	3.0102–3.5148	A+
30	*Fistularia commersonii*	L	48	31.4	63.2	0.0118	2.7274	0.1185	0.992	2.6738–2.7810	A–

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Table 1 cont.

No.	Species	Origin	N	L_{min}	L_{max}	Relation parameters					Growth type
						a	b	SE of b	r^2	95% CI of b	
31	*Gadiculus argenteus*	AM	534	5.7	10.7	0.0034	3.4790	0.0620	0.850	3.3558–3.6014	A+
32	*Glossanodon leioglossus*	AM	168	8.5	14.2	0.0029	3.2955	0.0779	0.971	3.1114–3.54796	A+
33	*Gobius cruentatus*	AM	51	8.2	16.4	0.0136	2.9321	0.1348	0.992	2.7796–3.0846	A–
34	*Gobius niger*	AM	531	7.9	16.0	0.008	3.1249	0.0296	0.959	3.0666–3.1830	A+
35	*Helicolenus dactylopterus*	AM	101	5.8	14.7	0.0093	3.2320	0.0350	0.988	3.1608–3.3032	A+
36	*Hoplostethus mediterraneus*	AM	211	5.2	16.1	0.0078	3.2190	0.0600	0.932	3.1001–3.3991	A+
37	*Labrus merula*	AM	45	17.1	25.6	0.0182	2.9685	0.0963	0.996	2.7246–3.2124	A–
38	*Labrus viridis*	AM	41	16.8	26.4	0.0238	2.8131	0.1127	0.994	2.7012–2.9250	A–
39	*Lampanyctus crocodilus*	AM	80	9.4	16.2	0.0069	3.1434	0.0421	0.967	3.0213–3.2655	A+
40	*Lepidorhombus boscii*	AM	67	7.7	17.2	0.0044	3.1990	0.0410	0.992	3.1171–3.2824	A+
41	*Lepidorhombus whiffiagonis*	AM	144	6.8	12.0	0.0269	3.2610	0.0330	0.926	2.9937–3.5288	A+
42	*Lepidotrigla cavillone*	AM	1673	4.1	18.1	0.0124	3.0293	0.0179	0.944	2.9939–3.0645	A+
43	*Lepidotrigla dieuzeidei*	AM	114	8.7	14.1	0.0128	2.9614	0.1537	0.971	2.8840–3.0388	A–
44	*Lesueurigobius friesii*	AM	765	3.6	9.4	0.0087	2.9634	0.0368	0.915	2.8256–2.9703	A–
45	*Lithognathus mormyrus*	AM	169	13.7	22.7	0.0124	2.9336	0.0427	0.999	2.8612–3.0061	A–
46	*Liza ramada*	AM	57	23.6	39.8	0.0224	2.7329	0.0118	0.992	2.6736–2.7922	A–
47	*Lophius budegassa*	AM	197	10.0	18.6	0.0118	3.0170	0.1000	0.820	2.8945–3.1186	A+
48	*Lophius piscatorius*	AM	126	18.7	64.3	0.0248	2.9136	0.0987	0.976	2.8109–3.0163	A–
49	*Macroramphosus scolopax*	C	189	5.9	12.0	0.0208	2.3770	0.1000	0.750	2.1786–2.5757	A–
50	*Merluccius merluccius*	AM	2868	8.1	47.6	0.0037	3.2273	0.0063	0.988	3.2147–3.2398	A+
51	*Mullus barbatus barbatus*	AM	2009	5.6	38.2	0.0065	3.3550	0.1830	0.970	3.1771–3.3361	A+
52	*Mullus surmuletus*	AM	140	7.5	28.3	0.0273	2.7960	0.0410	0.971	2.7143–2.8673	A–
53	*Mustelus mustelus*	AM	74	34.9	101.7	0.0053	2.8435	0.0982	0.989	2.6286–3.0584	A–
54	*Mustelus punctulatus*	AM	52	41.4	76.8	0.0224	3.0296	0.0435	0.996	2.8939–3.1653	I
55	*Nemipterus randalli*	L	118	11.8	22.9	0.0174	2.9243	0.0175	0.989	2.8561–2.9925	A–
56	*Oblada melanura*	AM	157	11.6	25.8	0.0174	2.8572	0.1257	0.994	2.7458–2.9686	A–
57	*Pagellus acarne*	AM	472	9.1	20.2	0.0121	3.2114	0.1366	0.923	3.1480–3.6582	A+
58	*Pagellus bogaraveo*	AM	113	7.8	15.9	0.0178	2.9625	0.0931	0.987	2.8712–3.0538	A–
59	*Pagellus erythrinus*	AM	531	5.7	20.4	0.0184	3.0128	0.0219	0.972	2.9697–3.0559	A+
60	*Parablennius tentacularis*	AM	72	7.1	11.6	0.0137	2.7625	0.4582	0.979	2.5650–2.9600	A–
61	*Peristedion cataphractum*	AM	56	6.9	18.2	0.0048	2.9756	0.0438	0.992	2.8799–3.0713	A–
62	*Pomadasys incisus*	AM	51	12.1	16.3	0.0197	2.8513	0.1447	0.930	2.7431–2.9826	A–

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Table 1 cont.

No.	Species	Origin	N	L_{min}	L_{max}	Relation parameters					Growth type
						a	b	SE of b	r^2	95% CI of b	
63	*Pomatoschistus minutus*	AM	59	3.5	5.2	0.0016	2.9635	0.2149	0.962	2.7101–3.2169	A–
64	*Raja miraletus*	C	62	26.7	49.3	0.0008	3.4392	0.2371	0.972	3.2100–3.6684	A+
65	*Raja radula*	E	38	43.7	66.5	0.0068	2.9718	0.2774	0.991	2.8982–3.0454	A–
66	*Salaria pavo*	AM	43	7.4	13.8	0.0113	3.0782	0.1774	0.995	2.8748–3.2816	A+
67	*Saurida undosquamis*	L	48	11.2	29.2	0.0037	3.2174	0.0512	0.981	2.9605–3.4743	A+
68	*Sciaena umbra*	AM	54	14.7	40.4	0.0136	3.0038	0.1957	0.979	3.7908–3.2168	A+
69	*Scomber japonicus*	C	31	14.3	18.8	0.0052	3.0936	0.1528	0.988	3.0112–3.1760	I
70	*Scophthalmus rhombus*	AM	92	29.7	48.4	0.0165	2.9178	0.2561	0.962	2.8027–3.0329	A–
71	*Scorpaena notata*	AM	314	8.6	17.3	0.0190	3.0041	0.0368	0.955	2.9315–3.0765	I
72	*Scorpaena porcus*	AM	63	7.7	26.8	0.0170	3.0449	0.0382	0.986	2.9688–3.1209	A+
73	*Scorpaena scrofa*	AM	74	9.6	42.9	0.0218	2.9637	0.0421	0.996	2.8690–3.0584	A–
74	*Scyliorhinus canicula*	AM	144	27.9	50.3	0.0012	3.2999	0.0786	0.925	3.1445–3.4552	A+
75	*Scyliorhinus stellaris*	AM	92	14.1	71.7	0.0039	2.9755	0.1049	0.987	2.7480–3.2030	A–
76	*Serranus cabrilla*	AM	1281	7.4	25.4	0.0112	2.9904	0.0113	0.981	2.9680–3.0126	A–
77	*Serranus hepatus*	AM	4987	4.4	11.7	0.0201	2.7510	0.0192	0.972	2.5582–2.9507	A–
78	*Serranus scriba*	AM	499	8.3	23.4	0.0093	3.1637	0.0158	0.987	3.1325–3.1948	A+
79	*Solea solea*	AM	171	18.6	33.7	0.0023	3.3691	0.0760	0.920	3.1290–3.5191	A+
80	*Sphyraena chrysotaenia*	L	35	18.0	24.0	0.0024	3.2510	0.0224	0.966	3.1387–3.4374	A+
81	*Spicara maena*	AM	528	9.0	18.1	0.0148	2.9675	0.0369	0.924	2.8947–3.0401	A–
82	*Spondyliosoma cantharus*	AM	79	8.6	18.7	0.0208	2.9956	0.0777	0.950	2.8407–3.1504	A–
83	*Squalus blainvillei*	C	80	17.7	62.9	0.0052	2.9640	0.0260	0.991	2.9111–3.0179	A–
84	*Symphodus cinereus*	AM	61	4.7	9.7	0.0050	3.5053	0.1352	0.919	3.3347–3.6758	A+
85	*Symphodus doderleini*	E	34	5.6	9.5	0.0202	2.8304	0.1145	0.983	2.7572–3.0855	A–
86	*Symphodus mediterraneus*	AM	38	4.7	16.6	0.0139	3.0029	0.0737	0.984	2.9558–3.0500	I
87	*Symphodus melanocercus*	E	41	5.9	9.4	0.0255	2.7372	0.2721	0.982	2.4654–3.090	A–
88	*Symphodus ocellatus*	E	274	4.6	9.0	0.0102	3.1307	0.0423	0.952	3.0474–3.2140	A+
89	*Symphodus rostratus*	E	42	6.7	12.5	0.0048	3.4125	0.0982	0.974	3.2124–3.6126	A+
90	*Symphodus tinca*	AM	110	6.6	22.0	0.0180	2.9243	0.0497	0.969	2.8256–3.0201	A–
91	*Syngnathus acus*	AM	21	9.1	25.3	0.0001	2.8935	0.0492	0.999	2.7457–3.0413	A–
92	*Torpedo marmorata*	AM	57	9.7	28.3	0.0721	2.5325	0.1614	0.981	2.4604–2.6046	A–
93	*Torpedo nobiliana*	AM	73	8.3	28.2	0.0519	2.7154	0.0537	0.998	2.5641–2.8667	A–
94	*Trachinus draco*	AM	59	18.1	33.9	0.0033	3.2278	0.0932	0.954	3.0411–3.4145	A+

Table continues on next page

Table 1 cont.

No.	Species	Origin	N	L_{min}	L_{max}	Relation parameters: a	b	SE of b	r^2	95% CI of b	Growth type
95	*Trachurus mediterraneus*	AM	53	8.7	16.7	0.0034	3.4347	0.1695	0.987	3.3130–3.5564	A+
96	*Trachurus picturatus*	AM	39	16.2	31.3	0.0044	3.1404	0.0726	0.983	2.9755–3.3053	A+
97	*Trachurus trachurus*	AM	539	8.7	14.7	0.0162	2.6790	0.0753	0.977	2.5249–2.8330	A–
98	*Trigla lyra*	AM	122	7.2	35.3	0.0069	3.0475	0.0698	0.992	2.9883–3.1067	A+
99	*Trigloporus lastoviza*	AM	702	8.7	21.1	0.0134	2.9730	0.0388	0.937	2.8965–3.0494	A–
100	*Upeneus moluccensis*	L	320	7.9	22.5	0.0070	3.1420	0.0677	0.970	3.0915–3.2247	A+
101	*Upeneus pori*	L	54	7.4	17.6	0.0058	3.1773	0.0314	0.972	3.0882–3.2664	A+
102	*Uranoscopus scaber*	AM	108	11.3	30.7	0.0087	3.2366	0.0433	0.975	3.1509–3.3223	A+
103	*Zeus faber*	C	68	7.8	45.9	0.0156	3.0478	0.0326	0.998	2.9696–3.1260	A+

N = sample size, L = length [cm], min = minimum, max = maximum, r^2 = coefficient of determination, a = intercept, b = slope, SE of b = standart error of b, CI = confidence interval, A (+) = positive allometry, A (–) = negative allometry, I = isometry, AM = Atlanto-Mediterranean, L = lessepsian, C = cosmopolitan, E = Mediterranean endemic species; Species are listed in alphabetical order according to the Froese and Pauly (2013).

cabrilla (Linnaeus, 1758); *Serranus hepatus* (Linnaeus, 1758); *Serranus scriba* (Linnaeus, 1758); *Solea solea* (Linnaeus, 1758); *Sphyraena chrysotaenia* Klunzinger, 1884; *Spicara maena* (Linnaeus, 1758); *Spondyliosoma cantharus* (Linnaeus, 1758); *Squalus blainvillei* (Risso, 1827); *Symphodus cinereus* (Bonnaterre, 1788); *Symphodus doderleini* Jordan, 1890; *Symphodus mediterraneus* (Linnaeus, 1758); *Symphodus melanocercus* (Risso, 1810); *Symphodus ocellatus* (Linnaeus, 1758); *Symphodus rostratus* (Bloch, 1791); *Symphodus tinca* (Linnaeus, 1758); *Syngnathus acus* Linnaeus, 1758; *Torpedo marmorata* Risso, 1810; *Torpedo nobiliana* Bonaparte, 1835; *Trachinus draco* Linnaeus, 1758; *Trachurus mediterraneus* (Steindachner, 1868); *Trachurus picturatus* (Bowdich, 1825); *Trachurus trachurus* (Linnaeus, 1758); *Trigla lyra* Linnaeus, 1758; *Trigloporus lastoviza* (Bonnaterre, 1788); *Upeneus moluccensis* (Bleeker, 1855); *Upeneus pori* Ben-Tuvia et Golani, 1989; *Uranoscopus scaber* Linnaeus, 1758; *Zeus faber* Linnaeus, 1758.

Out of the 103 fish species sampled, 84 (81.55%) were of the Atlanto-Mediterranean origin, 7 (6.80%) were endemic to the Mediterranean, 5 (4.85%) were cosmopolitan, and 7 (6.80%) were Lessepsian migrants (Table 1). Sparidae (10.7%; 11 species), Labridae (9.7%; 10 species), and Triglidae (6.8%; 7 species) were the most abundant families. Sample sizes ranged from 21 for *Syngnathus acus*, to 4987 for *Serranus hepatus* (Table 1). The sample size, minimum and maximum length for each species are presented in Table 1, as well as the WLRs, the coefficient of determination (r^2) and the standard error and confidence interval (CI) of b. Values of the allometric coefficient (b) ranged from 2.1729 for *Cepola macrophthalma* to 3.6372 for *Equulites klunzingeri* (Table 1). The mean value of b (± standard deviation) was 3.029 (± 0.2756) and the median b was 3.0031, with 50% of the b values being between 2.924 and 3.183. Overall, the values of the parameter b vary between 2 and 4 (Tesch 1971). In the presently reported study 94.2% of the 103 species had b values within the expected range of 2.5–3.5 (Koutrakis and Tsikliras 2003) with 2.5325 for *Torpedo marmorata* and 3.4790 for *Gadiculus argenteus*. All relations were highly significant ($P < 0.001$), with the majority of (94.17% of 103 species) r^2 values being greater than 0.9 (Table 1). There were only six exceptions: *Macroramphosus scolopax*, *Lophius budegassa*, *Belone svetovidovi*, *Gadiculus argenteus*, *Buglossidium luteum*, and *Capros aper* (Table 1). Concerning the type of growth, 4 species (3.9% of the total species number) showed isometric growth (b = 3), 50 species (48.5%) positive allometry ($b > 3$), and 49 species (47.6%) negative allometry ($b < 3$).

Fish samples in this study were intermittently collected throughout the year. Estimated WLR parameters should be considered only as mean annual values for most of these species since the data were collected over an extensive period of time and are not representative of any particular season (Dulčić and Glamuzina 2006). As stressed by Bagenal and Tesch (1978) and Petrakis and Stergiou (1995), the use of these relations should be limited to the size range used to estimate the parameters.

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