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Length-Weight Relationships of 11 Lessepsian Migrant Fish Species Caught from Antalya Bay (Turkey)

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Research Article

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Abstract

Length-weight relationships (LWRs) parameters were calculated for 11 lessepsian migrant fish species, *Pempheris vanicolensis* Cuvier, 1831, *Siganus luridus* (Rüppell, 1829), *Siganus rivulatus* Forsskål & Niebuhr, 1775, *Saurida undosquamis* (Richardson, 1848), *Sargocentron rubrum* (Forsskål, 1775), *Upeneus moluccensis* (Bleeker,1855), *Stephanolepis diaspros* Fraser-Brunner, 1940, *Etrumeus sadina* (Mitchill, 1814), *Dussumieria elopsoides* Bleeker, 1849, *Lagocephalus sceleratus* (Gmelin, 1789) and *Lagocephalus spadiceus* (Richardson, 1845). A total of 288 specimens were collected between 2009-2010 fishing seasons by middle trammel nets. Values of the allometric coefficient (*b*) ranged from 2.649 for *L. sceleratus* 3.392 for *D. elopsoides*.

Key Words: Length-weight relationships, lessepsian, Antalya Bay

Antalya Körfezi'nden 11 Lesepsiyen Göçmeni Balık Türüne Ait Boy-Ağırlık İlişkisi

Özet

Lesepsiyen göçmeni 11 balık türü, *Pempheris vanicolensis* Cuvier, 1831, *Siganus luridus* (Rüppell, 1829), *Siganus rivulatus* Forsskål & Niebuhr, 1775, *Saurida undosquamis* (Richardson, 1848), *Sargocentron rubrum* (Forsskål, 1775), *Upeneus moluccensis* (Bleeker,1855), *Stephanolepis diaspros* Fraser-Brunner, 1940, *Etrumeus sadina* (Mitchill, 1814), *Dussumieria elopsoides* Bleeker, 1849, *Lagocephalus sceleratus* (Gmelin, 1789) *and Lagocephalus spadiceus* (Richardson, 1845) için boy-ağırlık ilişkisi hesaplanmıştır. Bu çalışmada orta su trolü kullanılarak, 2009-2010 yıllarında balık avının serbest olduğu dönemlerde toplamda 288 birey elde edilmiştir. Boy-ağırlık ilişkisine ait *b* değeri *L. sceleratus* için 2,649 ve *D. elopsoides* için 3,392 olarak hesaplanmıştır.

Anahtar Kelimeler: Boy-ağırlık ilişkisi, lesepsiyen, Antalya Körfezi

INTRODUCTION

In 1869, after the opening of the Suez Canal, a migration began from the Red Sea to the eastern Mediterranean Sea, and some Lessepsian fish species able to adapt quickly to the new environment (Erguden et al., 2009). According to Bilecenoglu et al. (2002), the number of Lessepsian fish species was 33 from the coasts of Turkey. However, recently, the number of Lessepsian fish species rapidly increased in the Mediterranean. For example, the Indo-Pacific origin of the non-indigenous fish species is represented with 73 species (Turan et al., 2018).

Length-weight relationships (LWRs) are important because they: (a) allow the conversion of growth in length equations to growth-in-weight, for use in stock assessment model; (b) allow the estimation of biomass from length observations; (c) allows an estimate of the condition of fish; and (d) are useful for between-region comparisons of life histories of a certain species (Wootton, 1990; Pauly, 1993; Petrakis and Stergiou, 1995; Gonçalves et al., 1997; Moutopoulos and Stergiou, 2002). Length-weight relationships of 11 Lessepsian fish species were researched from Antalya Bay (Turkey).

MATERIALS and METHODS

Samples were collected between 2009 and 2010 during fishing seasons by middle trammel nets. Fish species were identified according to Whitehead, Bauchot et al (1986), *fishbase* (Froese and Pauly 2019), and Golani et al. (2006). Individuals were measured to 0.1 cm total length (TL) and weighted (W) with a digital balance to 0.01 g. The length-weight relationship (LWR) was calculated by the equation $W = a L^b$ where W is the bodyweight of fish, L is the total length of fish. The parameters *a* and *b* were calculated by linear regression on the transformed equation: $\log W = \log a + b \log L$ (Ricker, 1973), as was the coefficient of determination (r^2).

RESULTS and DISCUSSION

Totals of 288 fish specimens were caught in Antalya Bay. The sample size ranged from 7 individuals for *S. diaspros* to 68 for *E. sadina.* 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*. The values of the allometric coefficient (*b*) ranged from 2.649 for *L. sceleratus* to 3.392 for *D. elopsoides* (Table 1). The mean value of *b* (± standard deviation) was 3.0125 (±0.2089). The median value of b was 3.021 and 50% of the values ranged between 2.846 and 3.165. Overall, the values of the parameter *b* vary between 2 and 4 (Tesch 1971). Concerning the type of growth, 7 species (63.7% of the total species number) positive allometry ($b > 3$), and 4 species (36.3% of the total species number) negative allometry ($b < 3$). There were no differences observed between previously reported *b*-values and those estimated in the present study for six species (*D. elopsoides, L. spadiceus, P. vanicolensis, S. rubrum, S. undosquamis, U. moluccensis*) (Table 1). However, there were differences observed between previously reported *b*-values and those estimated in the present study for three species (*E. sadina, S. luridus, S. diaspros*). Additionally, *b*-value of one species (*S. rivulatus*) was similar to Taskavak and Bilecenoglu, (2001) but it was different with Erguden et al. (2009). The coefficient of determination (r^2) values ranged from 0.886 for *D. elopsoides* to 0.984 *L. spadiceus.* Shortly as a result of the study, some species (*U. moluccensis, S. rivulatus, S. luridus, S. rubrum, P. vanicolensis, E. sadina and D. elopsoides*) exhibited positive allometric growth, while others (*L. sceleratus, L. spadiceus, S. undosquamis and S. diaspros*). The length-weight relationship in fish is affected by several factors including gonad maturity, sex, diet, stomach fullness, health, and preservation techniques as well as season and habitat (Petrakis and Stergiou, 1995), none of which were taken into consideration in the present study. Furthermore, data recorded in this study were not representative for all months within a year. Nevertheless, WLR estimated are of high importance for fisheries research in the area.

According to Elbaraasi, (2014), most of Lessepsian fish species adapted rapidly to the new environment of the Mediterranean to establish new populations. Furthermore, the newly established populations become economically important for the local community. Yet, in most cases, they become an invasive dangerous species to the Mediterranean ichthyofauna profile. Therefore, more studies must focus on fisheries management, population growth, and feeding habits of invasive fish species. Additionally, the Physico-chemical properties of the environment should be monitored due to the changing climatic conditions.

Table 1. Estimated parameters of length-weight relationships for 11 Lessepsian fish spesies caught in Antalya Bay, from the eastern Mediterranean coasts of Turkey and previously studies from other areas (C: combined; N: sample size; SE: standard eror; SD: standard deviations; *a* and *b*: parameters of the length-weight relationship; r^2: coefficient of determination; 95%CI of *b*: 95% Confidence Intervals of *b*) (*: TL is mm for Taskavak and Bilecenoglu, (2001); **: Erguden et al., (2009) given SD instead of SE).

		Length Characteristics				Parameters of LWR					
Species-Area	**Sex**	**N**	**Mean**	**SE**	**Range**	***a***	***b***	**SE(*b*)**	**95%CI of *b***	**r^2**	**References**
Dussumieria elopsoides											**Present study**
Gulf of Antalya	C	30	13.20	0.172	11.5-16.5	0.0028	3.392	0.229	3.282-3.503	0.8868	Erguden et al., 2009
Iskenderun Bay	C	59	1422	2.02**	9.90-16.40	0.0055	3.123	0.048	3.028–3.219	0.987	
Etrumeus sadina											
Gulf of Antalya	C	68	18.18	0.271	14.6-24.1	0.0081	3.021	0.132	2.756-3.286	0.8869	**Present study**
Iskenderun Bay	C	61	13.46	1.63**	10.00-16.70	0.0078	2.989	0.072	2.846-3.133	0.967	Erguden et al., 2009
Lagocephalus sceleratus											
Gulf of Antalya	C	11	28.02	2.925	19.0-50.2	0.0304	2.649	0.136	2.329-2.969	0.9768	**Present study**
Lagocephalus spadiceus											
Gulf of Antalya	C	14	25.10	1.838	18.0-39.2	0.0215	2.888	0.106	2.657-3.119	0.984	**Present study**
Iskenderun Bay	C	89	15.94	4.98**	6.90-26.90	0.0204	2.901	0.076	2.748-3.051	0.943	Erguden et al., 2009
Mersin and Iskenderun Bays	C	19	180.22	4.86	159-199	0.0000208	2.951	0.093		0.97	Taskavak and Bilecenoglu, 2001*
Pempheris vanicolensis											
Gulf of Antalya	C	14	14.20	0.254	12.1-16.0	0.0116	3.165	0.301	2.509-3.821	0.9021	**Present study**
Mersin and Iskenderun Bays	C	46	117.15	6.69	77-155	0.000113	3.026	0.034		0.95	Taskavak and Bilecenoglu, 2001*
Sargocentron rubrum											
Gulf of Antalya	C	39	15.02	0.344	9.4-18.4	0.0158	3.071	0.081	2.906-3.236	0.9745	**Present study**
Mersin and Iskenderun Bays	C	38	147.67	6.18	120-167	0.0000174	3.015	0.099		0.94	Taskavak and Bilecenoglu, 2001*
Saurida undosquamis											
Gulf of Antalya	C	54	20.40	0.438	14.3-31.0	0.0107	2.846	0.234	2.375-3.317	0.9035	**Present study**
Iskenderun Bay	C	304	19.92	7.81**	8.20-34.00	0.0063	2.968	0.019	2.931-3.005	0.988	Erguden et al., 2009
Siganus luridus											
Gulf of Antalya	C	21	14.90	0.451	11.6-21.5	0.0166	3.008	0.137	2.721-3.295	0.9619	**Present study**
Iskenderun Bay	C	21	14.19	5.93**	14.50-16.30	0.0136	2.920	0.162	2.581-3.259	0.945	Erguden et al., 2009
Siganus rivulatus											
Gulf of Antalya	C	16	18.20	0.459	14.3-22.1	0.0098	3.097	0.255	2.550-3.644	0.9128	**Present study**
Iskenderun Bay	C	122	15.61	0.80**	14.10-18.	0.0170	2.823	0.089	2.646-3.000	0.892	Erguden et al., 2009
Mersin and Iskenderun Bays	C	355	169.32	11.96	107-241	0.0000047	3.203	0.042		0.98	Taskavak and Bilecenoglu, 2001*
Stephanolepis diaspros											
Gulf of Antalya	C	7	11.60	0.574	9.6-13.9	0.0287	2.795	0.242	2.203-3.387	0.9639	**Present study**
Iskenderun Bay	C	56	11.62	1.77**	8.00-13.50	0.0146	3.083	0.055	2.974-3.193	0.983	Erguden et al., 2009
Mersin and Iskenderun Bays	C	207	89.27	2.41	71-130	0.0000068	3.186	0.103		0.92	Taskavak and Bilecenoglu, 2001*
Upeneus moluccensis											
Gulf of Antalya	C	14	12.4	0.499	10.3-16.3	0.0079	3.201	0.261	2.642-3.760	0.9259	**Present study**
Iskenderun Bay	C	297	11.98	2.49**	5.00-17.70	0.0034	3.439	0.047	3.345–3.532	0.947	Erguden et al., 2009
Mersin and Iskenderun Bays	C	265	136.12	3.37	102-170	0.0000135	3.021	0.039		0.97	Taskavak and Bilecenoglu, 2001*

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