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# A REVIEW OF LENGTH-WEIGHT RELATIONSHIPS OF LESSEPSIAN FISHES FROM TURKISH SEAS

**ABSTRACT**

In this review, Length-weight relationships are presented for Lessepsian fish species from Turkish seas in the years of 1993-2006. The values of the slope b mostly remained within the range from 2.23 for Scomberomorus commerson to 3.564 for Upeneus moluccensis. The median value of b was calculated as 3.028 and 50% of the values variedfrom 2.896 to 3.22. The $R^2$ values ranged from 0.72 for Upeneus moluccensis to 0.998 for Apogon nigripinnis and Saurida undosquamis, and all regressions were highly significant ($P<0.005$).

**Keywords:** Length-Weight Relationship, Lessepsian Fish, Turkish Seas

# TÜRKİYE DENİZLERİNDEKİ LESEPSİYEN BALIKLARIN BOY-AĞIRLIK İLİŞKİLERİ ÜZERİNE BİR ÇALIŞMA

**ÖZET**

Bu derlemede, Türkiye denizlerindeki Lesepsiyen balıkların 1993-2006 yılları arasındaki boy-ağırlık ilişkileri sunulmuştur. b değeri endüşük 2.23 (Scomberomorus commerson türü için), en yüksek 3.564 (Upeneus moluccensis türü için), medyan değeri 2.946 bunun %25-75'i 2.774 ve 3.124 arasında bulunmuştur. $R^2$ değerleri, Upeneus moluccensis türü için 0.72, Apogon nigripinnis ve Saurida undosquamis türleri için 0.998 olarak bulunmuştur. Regresyon değerleri oldukça önemli bulunmuştur ($P<0.005$).

**Anahtar Kelimeler:** Boy-Ağırlık İlişkisi, Lesepsiyen Balık, Türkiye Denizleri

## 1. INTRODUCTION (GİRİŞ)

The first immigrant fish namely *L. klunzingeri* was reported by Erazi (1943) in Iskenderun Bay. A total of 33 immigrant fish species, belonging to 26 families, were reported by several authors from Turkish coasts (Taskavak *et al*., 2002).

Knowledge of the length-weight relationship (LWR) of a fish species in a given geographic region is used to provide information on the condition of fish (Petrakis and Stergiou, 1995). The LWR are very useful for at least four reasons; a) For the estimation of standing-crop biomass when the length-frequency distribution is known; b) the estimation of biomass from length observations because of technical difficulties (e.g., because of bobbing motion of the boat) and the amouth of time required to record weight in the field); c) the calculation of condition incides in the analysis of ontogenetic changes; and d) the life stories and morfological comparisons of populations from different regions (Petrakis and Stergio, 1995; Stergio and Motopoulos, 2001).

## 2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

In this review, we reported 58 LWR gathered from the literature for 24 Lessepsian fish species inhabiting Turkish seas. In this study all LWR of Lessepsian fish species were reported from Turkish waters represent in the first time.

## 3. MATERIAL AND METHODS (MALZEME VE YÖNTEM)

All LWR gathared from publications, presented here are the product of field studies conducted during 1993-2006 in Turkish seas. For the majority of the orijinal LWR ($W=aL^b$ ), length was in cm and weight in g (29 relationships out of 58; 50%), whereas for 29 (50%) relationships, length and weight were expressed in mm and g.

## 4. RESULTS AND DISCUSSION (SONUÇLAR VE TARTIŞMA)

The LWR of 24 fish species representing 20 families are shown in Table 1. Overall, 17 out of the 58 length-weight relationships refer to *Upeneus moluccensis* (29.31%), 9 (15.51%) to *Saurida undosquamis* and 8 (13.79%) *Siganus rivulatus*, three of the most commercially important demersal lessepsian species in Turkish seas.

The value of the slope *b* in the plot of log W against log W ranged from 2.23 for *Scomberomorus commerson* Güllük and Gökova Bay, to 3.564 for U*peneus moluccensis* in East Mediterranean. The mean value of b was 3.033 (SD=0.256) and did not differ significantly from 3 (t-test, $p<0.05$). The median value of *b* was found as 3.028 and 50% of the values ranged from 2.896 to 3.22.

Eleven species (*Alepes djeddaba*, *Callionymus filamentosus, Cygnoglossus cinusarabici Liza carinata, Saurida undosquamis, Scomberomorus commerson Siganus rivulatus, Stephanolepis diaspros, Sphyraena crysotaenia, Upeneus moluccensis* and *Upeneus pori*,) showed negative allometric growth, while six species (*Apogon nigripinnis, Dussumieria elipsoides, Lagocephalus spadiceus, Pelates quadrilineatus, Pempheris vanicolensis* and *Sargocentron rubrum*) showed isometric growth (Table 1).

In general, samples of all species were obtained from throughout the year, thus these data are not representative of a particular season, except for *U. moluccensis* from Gökova Bay and Marmara, Aegean and Mediterranean Sea and thus estimated LWR parameters should be considered as mean annual values. According to Estimated parameters of LWR may differ among seasons and years primarily due to physico-chemical characteristics of enviroment, sex and maturity stage of a given species (Dulcic and Kraljevic, 1996 in Taşkavak and Bilecenoğlu,

2001). In contrast, it was stated that the annual variation of the parameter *b* is not significant, unlikely parameter a, which may even vary daily (Goncalves et al., 1997 in Taşkavak and Bilecenoğlu, 2001).

Table 1. Parameters of the length-weight relationship
(Tablo 1. Boy-ağırlık ilişkisi parametreleri

| Species Types of growth ( b= 3, P = 0.05) | Area | Sex | Year | S | L | a | b | SE (b) | $r^2$ | N | mean | min | max | SE | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Alepes djeddaba* -(A) | East. Mediterrane. | C | 1997 -98 | C | TL | 0.000745 | 2.816 | 0.048 | 0.86 | 70 | 153.70 | 130.0 | 192 | 1.92 | Taşkavak and Bilecenoğlu (2001) |
| *Apogon nigripinnis* I | East. Mediterrane. | C | 1997 -98 | C | TL | 0.000020 | 3.001 | 0.089 | 0.99 | 22 | 63.55 | 41 | 85 | 3.29 | Taşkavak and Bilecenoğlu (2001) |
| *Callionymus filamentosus* -(A) | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000265 | 2.835 | 0.016 | 0.96 | 92 | 83.36 | 58 | 102 | 2.04 | Taşkavak and Bilecenoğlu (2001) |
| *Cyglossus cinusarabici* -(A) | East.Medit | C | 97-98 | C | TL | 0.000080 | 2.482 | 0.017 | 0.96 | 32 | 113 | 96 | 133 | 2.55 | Bile (2001) |
| *Cynoglossus sinusarabici* -(A) | Mersin Bay | F | 1996 -97 | C | TL | 0.0072 | 2.962 | - | 0.955 | 235 | 9.91 | 4.5 | 15.5 | *2.92 | Çiçek et al. (2006) |
| *Cynoglossus sinusarabici* -(A) | East Medit. | C | 2001 -3 | C | TL | 0.0308 | 2.414 | 0.112 | 0.91 | 96 | 11.8 | 8.2 | 18.2 | 2.03 | Sangun et al., (2006) |
| *Dussumieria elipsoides* I | East. Mediterrane. | C | 1997 1998 | C | TL | 0.0000058 | 3.031 | 0.105 | 0.88 | 27 | 150.25 | 140 | 169 | 2.44 | Taşkavak and Bilecenoğlu (2001) |
| *Lagocephalus spadiceus* -(A) | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000208 | 2.951 | 0.093 | 0.97 | 19 | 180.22 | 159 | 199 | 4.86 | Taşkavak and Bilecenoğlu (2001) |
| *Leiognathus klunzingeri* I | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000035 | 3.271 | 0.094 | 0.96 | 156 | 78.55 | 49 | 104 | 1.35 | Taşkavak and Bilecenoğlu (2001) |
| *Leiognathus klunzingeri* I | Mersin Bay | C | 1999 2000 | C | TL | 0.0090 | 3.159 | **** | 0.96 | 2212 | 5.23 | 2.1 | 10.7 | *1.55 | Çiçek et al. (2006) |
| *Leiognathus klunzingeri* A (+) | East.Medit. | C | 2001 -3 | C | TL | 0.0075 | 3.224 | 0.035 | 0.97 | 632 | 7.27 | 1.9 | 10.0 | 1.46 | Sangun et al., 2007 |
| *Liza carinata* -(A) | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000221 | 2.864 | 0.139 | 0.94 | 15 | 177.00 | 167 | 187 | 3.86 | Taşkavak and Bilecenoğlu (2001) |
| *Oxyurichtyes petersi* I | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000089 | 3.057 | 0.020 | 0.98 | 112 | 103.93 | 61 | 122 | 5.08 | Taşkavak and Bilecenoğlu (2001) |
| *Pelates quadrilineatus* -(A) | East. Mediterrane. | C | 1997 -98 | C | TL | 0.0000148 | 2.958 | 0.013 | 0.97 | 76 | 102.15 | 79 | 121 | 2.47 | Taşkavak and Bilecenoğlu (2001) |
| *Pempheris vanicolensis* I | East. Mediterrane. | C | 1997 -98 | C | TL | 0.000011 | 3.026 | 0.034 | 0.95 | 46 | 117.15 | 77 | 155 | 6.69 | Taşkavak and Bilecenoğlu (2001) |
| *Pomadasys incicus* -(A) | İskenderun Bay | C | 2000 | C | TL | 0.00465 | 2.604 | 0.080 | 0.91 | 106 | 16.12 | 13.40 | 21.02 | 1.75 | Can et al., (2002) |
| *Pomadasys incicus* -(A) | East Medit. | C | 2001 -3 | C | TL | 0.0199 | 2.834 | 0.162 | 0.97 | 23 | 15.0 | 11.9 | 19.0 | 1.91 | Sangun et al., 2007 |
| *Stephanolepis diaspros* I | East Medit. | C | 2001 -3 | C | TL | 0.0276 | 2.832 | 0.092 | 0.98 | 52 | 10.9 | 7.3 | 14.2 | 1.77 | Sangun et al., 2007 |
| *Sargocentron rubrum* I | İskenderun Bay | C | 2000 | C | TL | 0.0091 | 3.267 | 0.0140 | 0.86 | 57 | 15.17 | 12.90 | 21.4 | 1.34 | Can et al., (2002) |
| *Sargocentron rubrum* I | East. Mediterrane. | C | 1997 -98 | C | TL | 0.000017 | 3.015 | 0.099 | 0.94 | 38 | 147.67 | 120 | 167 | 6.18 | Taşkavak and Bilecenoğlu (2001) |
| *Saurida undosquamis* -(A) | İskenderun Bay | C | 2000 | C | TL | 0.0117 | 2.797 | 0.0105 | 0.90 | 100 | 26.4 | 17.4 | 33.1 | 3.89 | Can et al., (2002) |
| *Saurida undosquamis* -(A) | İskenderun Bay | F | 1999 2000 | C | TL | 0.120 | 2.95 | | 0.98* | 368 | | 9.0 | 35.0 | | İşmen (2002) |
| *Saurida undosquamis* I | İskenderun Bay | M | 1999 2000 | C | TL | 0.088 | 3.19 | | 0.99* | 234 | | 5.0 | 32.0 | | İşmen (2002) |
| *Saurida undosquamis* -(A) | İskenderun Bay | C | 2000 | C | TL | 0.0117 | 2.797 | 0.0105 | 0.90 | 100 | 26.4 | 17.4 | 33.1 | 3.89 | Can et al., (2002) |
| *Saurida undosquamis* I | İskenderun Bay | C | 1992 1993 | C | FL | -2.0617 | 3.022 | - | 0.999* | 333 | - | 8.3 | 21.92 | | Türeli & Erdem (1997) |
| *Saurida undosquamis* I | Fethiye Bay | C | 1993 | C | FL | -1.3279 | 3.295 | | 0.828* | 430 | - | 17.3 | 30.8 | - | Mater & Torcu (1997) |
| *Saurida undosquamis* -(A) | Mersin Bay | C | 1993 | C | FL | -0.9596 | 2.616 | | 0.656* | 100 | - | 13.5 | 32.2 | - | Mater & Torcu (1997) |
| *Saurida undosquamis* I | İskenderun Bay | C | 1992 -93 | C | FL | -2.06171 | 3.022 | | 0.998* | 333 | - | 8.3 | 21.92 | - | Türeli & Erdem (1997) |
| *Scomberomorus commerson* -(A) | Güllük and Gökova Bay | C | 1994 | C | TL | 0.1567 | 2.223 | | 0.885* | 70 | - | 52.0 | 87.0 | - | Buhan et al. (1997) |
| *Siganus rivulatus* -(A) | Fethiye Bay | C | 2004 2005 | C | TL | 0.024 | 2.80 | | 0.87* | 121 | 17.55 | 14.2 | 22.0 | 3.63 | Selçuk et al., (2005) |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Siganus rivulatus* I | Antalya Bay | F | 1996-98 | C | TL | 0.0064 | 3.221 | | 0.903* | 292 | 15.12 | 7.0 | 21.5 | 0.32 | Bilecenoglu & Kaya (2002) |
| *Siganus. rivulatus* I | Antalya Bay | M | 1996-98 | C | TL | 0.007945 | 3.135 | | 0.903* | 229 | 16.09 | 7.1 | 20.6 | 0.34 | Bilecenoglu & Kaya (2002) |
| *Siganus rivulatus* I | Antalya Bay | C | 1996-98 | C | TL | 0.007137 | 3.179 | | 0.903* | 521 | - | 7.0 | 21.5 | - | Bilecenoglu & Kaya (2002) |
| *Siganus rivulatus* I | East. Mediterrane. | C | 1997-98 | C | TL | 0.0000047 | 3.203 | 0.042 | 0.98 | 355 | 169.32 | 107 | 241 | 11.96 | Taşkavak and Bilecenoğlu (2001) |
| *Siganus rivulatus* I | East. Mediterranean | C | 1995-96 | C | TL | 0.0082 | 3.118 | | 0.942* | 414 | - | 11.83 | 19.6 | - | Yeldan (1996) |
| *Saurida undosquamis* A (+) | East Medit. | C | 2001-3 | C | TL | 0.0039 | 3.159 | 0.044 | 0.96 | 416 | 17.6 | 10.6 | 26.1 | 2.7 | Sangun et al., (2007) |
| *Upeneus moluccensis* A (+) | East Medit. | C | 2001-3 | C | TL | 0.0024 | 3.564 | 0.0027 | 0.98 | 651 | 10.79 | 7.0 | 18.0 | 2.01 | Sangun et al., (2007) |
| *Siganus rivulatus* I | East. Mediterranean | F | 1995-96 | F | TL | 0.0061 | 3.220 | | 0.949* | 224 | - | 11.8 | 20.5 | | Yeldan(1996) |
| *Siganus rivulatus* I | East. Mediterranean | M | 1995-96 | M | TL | 0.0088 | 3.089 | | 0.926* | 190 | - | 15.38 | 18.7 | | Yeldan(1996) |
| *Sillago shima* I | East. Mediterrane. | C | 1997-98 | C | TL | 0.0000014 | 3.355 | 0.101 | 0.93 | 108 | 142.19 | 94 | 203 | 8.79 | Taşkavak and Bilecenoğlu (2001) |
| *Sphyraena crysotaenia* -(A) | East. Mediterrane. | C | 1997-98 | C | TL | 0.000029 | 2.632 | 0.027 | 0.96 | 54 | 158.80 | 126 | 231 | 11.66 | Taşkavak and Bilecenoğlu (2001) |
| *Stephanolepis diaspros* I | East. Mediterrane. | C | 1997-98 | C | TL | 0.0000068 | 3.186 | 0.103 | 0.92 | 207 | 89.27 | 71 | 130 | 2.41 | Taşkavak and Bilecenoğlu (2001) |
| *Upeneus moluccensis* I | East. Mediterrane. | C | 1997-98 | C | TL | 0.0000135 | 3.021 | 0.039 | 0.97 | 265 | 136.12 | 102 | 170 | 3.37 | Taşkavak and Bilecenoğlu (2001) |
| *Upeneus moluccensis* I | İskenderun Bay | F | 1999 2000 | C | TL | 0.0117 | 3.00 | - | 0.99* | 216 | - | 6.9 | 20.5 | - | İşmen. (2005) |
| *Upeneus moluccensis* -(A) | İskenderun Bay | M | 1999 2000 | C | TL | 0.0118 | 2.99 | - | 0.99* | 202 | - | 6.0 | 17.8 | - | İşmen (2005) |
| *Upeneus moluccensis* I | Gökova Bay | C | 1993 | AUT | TL | 0.00606 | 3.351 | | 0.962* | 39 | - | - | - | - | Benli et al. (2000) |
| *Upeneus moluccensis* I | Mediterranean Sea | F | 1991-92 | C | FL | 0.01051 | 3.150 | | 0.945* | 535 | 13.69 | 8.6 | 17.8 | 1.635 | Kaya et al. (1999) |
| *Upeneus moluccensis* I | Mediterranean Sea | M | 1991-92 | C | FL | 0.00607 | 3.352 | | 0.922* | 176 | 11.16 | 8.5 | 16.1 | 1.378 | Kaya et al. (1999) |
| Upeneus moluccensis I | Fethiye Bay | C | 1990-93 | - | FL | -1.2889 | 3.386 | | 0.828* | 536 | - | 9.0 | 17.0 | - | Torcu & Mater (1997) |
| *Upeneus moluccensis* -(A) | Mersin Bay | C | 1990-93 | - | FL | -1.0554 | 2.903 | | 0.723* | 500 | - | 8.9 | 16.0 | - | Torcu & Mater (1997) |
| *Upeneus moluccensis* I | Marmara, Aegean and Mediterranean | C | 1991-93 | SP | FL | 0.000004 | 3.257 | | 0.976* | 152 | - | 81.0 | 167.0 | - | Anonymous (1993) |
| *Upeneus moluccensis* I | Marmara, Aegean and Mediterranean | C | 1991-93 | SU | FL | 0.000004 | 3.30 | | 0.947* | 300 | - | 93.0 | 176. | - | Anonymous (1993) |
| *Upeneus moluccensis* -(A) | Marmara, Aegean and Mediterranean | C | 1991-93 | AUT | FL | 0.000026 | 2.896 | | 0.956* | 207 | - | 86.0 | 178. | - | Anonymous (1993) |
| *Upeneus moluccensis* I | Marmara, Aegean and Mediterranean | C | 1991-93 | WI | FL | 0.0000027 | 3.353 | | 0.941* | 120 | - | 93.0 | 173.0 | - | Anonymous (1993) |
| *Upeneus pori* I | East. Mediterrane. | C | 1997-98 | C | TL | 0.0000028 | 3.256 | 0.085 | 0.9 8 | 102 | 113.50 | 91 | 147 | 4.38 | Taşkav and Bilec(2001 |
| *Upeneus pori* I | Northeast. Mediterran. | C | 1999 2000 | C | TL | 0.0083 | 3.069 | - | 0.96 | 1221 | 10.48 | 5.1 | 15.5 | 1.47 | Çiçek et al. (2006) |
| *Upeneus pori* I | East. Mediterrane. | F | 1999 2000 | C | TL | 0.0073 | 3.121 | - | 0.96 | 590 | 10.60 | 6.5 | 15.5 | 1.48 | Çiçek et al. (2006) |
| *Upeneus pori* -(A) | East. Mediterrane. | M | 1999 2000 | C | TL | 0.0103 | 2.977 | - | 0.96 | 619 | 10.44 | 6.3 | 14.7 | 1.38 | Çiçek et al. (2006) |

$W=a\ L^b$ [weight (g) and length (cm)], Sex (M, male; F, female; C, combined; U, unidentified) year=year of sampling; S=sampling season (AUT, Autumn; WI, Winter; SP, Spring; SU, Summer; C, All season combined). L=(TL, Total length; FL, Fork length; SL, Standart length); a=the intercept of the relationship provided by source; b=the slope of the relationship $W=aL^b$; $r^2$= coefficient of determination;
*r converted into $r^2$
**Length-weight relationship corresponding to mm, g

**REFERENCES (KAYNAKLAR)**


- Anonymous, (1993). Final report of demersal fisheries resource survey in the Rebuplic of Turkey. Sanyo-Techno-Marine Inc., by Japan Intern. Cooperation Agency, 254 p.
- Yeldan, H., (1996). Growth and reproduction aspects of Rabbit fish, *Siganus rivulatus* (Forsskal., 1775) in the Eastern Mediterranean, MSc.Thesis, C.U., Inst.of Science and Technology, 59 pp.
- Mater, S. and Torcu, H., (1996). An investigation on the biology of lizard fish, (*Saurida undosquamis* Richarson, 1842) in Mersin and Fethiye Gulfs, in the proceedings of the XIII. National Biology Congress, 1997, University of Istanbul, 17-20 September, 1996, Cilt V: 178-189, pp:425-434.
- Torcu, H. and Mater, S., (1997). An investigation on biological aspects of the golden-banded goat fish *Upeneus moluccensis* (Bleeker, 1859) living in Fethiye and Mersin Gulf, In the proceedings of Mediterranean Fisheries Congress, 9-11 April 1996, pp:545-554.
- Türeli, C. and Erdem, Ü., (1997). The growth performance of red mullet (*Mullus barbatus Linneaus*, 1758) and brushtooth lizardfish (*Saurida undosquamis* (Richardson, 1848)) from the costal region of Adana province (Iskenderun Bay, Turkey). Turk J. Zool. 21, pp:329-334..
- Buhan, E., Yılmaz, H., Morkan, Y., Büke, E., and Yüksek, A., (1997). A new catch potential for Güllük bay and Gökova bay *Scomberomorus commerson* (Lacepede, 1800) (Pisces-Teleostei). In the proceedings of Mediterranean Fisheries Congress, Izmir, 9-11 April 1997, pp:937-944.
- Kaya, M., Benli, H.A., Katagan, T., and Ozaydin, O., (1999). Age, growth, sex-ratio, spawning season and food of golden banded goatfish, *Upenus moluccensis* Bleeker (1855) from the Mediterranean and south Aegean Sea coasts of Turkey. Fish. Res. 41, pp:317-328.
- Stergiou, K.I. and Moutopoulos, D.K., (2001), A review of length-weight relationships of fishes from Greek Marine Waters. Naga, The ICLARM Quarterly. 24 (1-2), pp:23-39.
- Bilecenoglu, M. and Kaya, M., (2002). Growth of marbled spinefoot *Siganus rivulatus* Forsskål, 1775 (Teleostei: Siganidae) introduced to Antalya Bay, the eastern Mediterranean Sea, Turkey. Fish. Res. 54, pp:279-285.
- Can, M.F., Basusta, N., and Cekic, M., (2002). Weight-length relationships for selected fish species of the small-scale fisheries off the south coast of Iskenderun Bay. Turk J. Vet. Anim. Sci. 26, pp:1181-1183.
- Cicek, E., Avsar, D., Yeldan, H., and Ozütok, M., (2002). Population characteristics of the Por's goatfish (*U. pori* Ben Tuvia and Golani, 1989) inhabiting Babadillimanı bight (Northeastern Mediterranean). In the proceedings of Lessepsian Migration Workshop, Gökceada, 20-21 July 2002, Turk Mar. Res. Found. (eds. B. Oztürk & N. Basusta), 9, pp:92-99.
- Ismen, A., (2002). Age, growth, sex ratio, spawning season of lizardfish (*S. undosquamis Richardson*, 1848) in the Iskenderun Bay, the eastern Mediterranean Sea. In the proceedings of Lessepsian Migration Workshop, Gökçeada, 20-21 July 2002, Turk Mar. Res. Found. 9, pp:108-115.

- İşmen, A., (2005). Age, growth and reproduction of the Goldband Goatfish, *Upeneus moluccensis* (Bleeker, 1855), İskenderun Bay, the Eastern Mediterranean, Turk J. Zool., 20, pp:301-309.
- Çiçek, E., Avşar, D., Yeldan, H., Özütok, M., (2006). Length–weight relationships for 31 teleost fishes caught by bottom trawl net in theBabadillimani Bight (northeastern Mediterranean), J. Appl. Ichthyol. 22, pp:290–292.
- İşmen, A., (2006). Growth and Reproduction of Por's Goatfish (*Upeneus pori* Ben-Tuvia & Golani, 1989) in Üskenderun Bay, the Eastern Mediterranean. Turk J Zool., 30, pp:91-98.
- Sangun, L., Akamca, E., and Akar, M., (2007). Length–weight relationships for 39 fish species from North- Eastern Mediterranean Coasts of Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 7, pp:37-40.
- Taşkavak, E. and Bilecenoğlu, M., (2001). Length–weight relationships for 18 Lessepsian (Red Sea) immigrant fish species from the eastern Mediterranean coasts of Turkey. J. Mar. Biol. Ass. U.K. 81, pp:895-896.
- Petrakis, G., Stergiou, K.I., 1995. Weight-length relationships for 33 fish species in Greek waters. Fish. Res. 21, pp:465-469.
- Erazi, R.A.R., 1943. *Leiognathus klunzingeri* nov. sp.. Compte Rend. Soc. Turq. Sci. Phys., 10, pp:49-53.
- Taskavak, E., Bilecenoglu, M., and Kunt, K.B., (2002). Range extension of three lessepsian migrant fish (*Fustilaria commersonii*, *Sphyraena flavicauda*, *Lagocephalus suezensis*) in the Mediterranean Sea, J. Mar. Biol. Ass. U.K., 82, pp:525-526.
- Gonçalves, J.M.S., Bentes, L., Lino, P.G., Ribeiro, J., Canario, A.V.M., and Erzini, K., (1997). Weight–length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. Fish. Res. 30, pp:253–256.
- Dulcic, J. ve Kraljevic, M., (1996). Weight-length relationships for 40 fish species in the Eastern Adriatic (Croatian waters). Fish. Res. 28, pp:243-251.