African Journal of Agricultural Research Vol. 7(28), pp. 4061-4065, 24 July, 2012
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR11.1985
ISSN 1991-637X ©2012 Academic Journals

Full Length Research Paper

Length-weight relationship and condition of five marine fish species collected by shrimp trawls in Bushehr coastal waters, Northern Persian Gulf

Moslem Daliri[1]*, Seyed Yousef Paighambari[1], Mohammad Javad Shabani[2] and Reza Davoodi[3]

[1]Fisheries Department, Gorgan University of Agricultural Sciences and Natural Resources, Iran.
[2]Iran Shrimp Research Centre. Bushehr, Iran.
[3]Agricultural and Natural Resources College, Persian Gulf University. Bushehr, Iran.

Accepted 15 June, 2012

The length-weight relationships (LWR) and relative condition factor were calculated for five marine fish species collected by shrimp trawls from Iranian waters of the Persian Gulf. Sampling was carried out with bottom trawl net (with 40 and 50 mm mesh size (stretched length) in the cod-end and panel) during June to August 2011. Trawling took place at depths ranging from 7 to 30 m. The values of the exponent *b* varied between 2.7300 (*Sillago sihama*) and 3.0156 (*Netuma thalassinus*). Relative condition factor (K_{rel}) did not differ significantly (analysis of variance (ANOVA) test, P > 0.05) and ranged from 0.98 ± 0.14 (*Pelates quadrilineatus*) to 1.03 ± 0.17 (*N. thalassinus*).

Key words: Length-weight relationship, marine fish, condition factor, Persian Gulf.

INTRODUCTION

Length-weight relationships are very important in fisheries management for comparison of growth studies (Garcia et al., 1998; Haimovici and Velasco, 2000; Moutopoulos and Stergiou, 2002; Hossain et al., 2006). Data on length-weight is applied to estimate the weight of an individual of given length or total weight from length-frequency distribution (Forese, 1998; Koutrakis and Tsikliras, 2003). Also, data of length-weight and age can give knowledge on the stock composition, length at maturity, lifetime, mortality, growth, and production (Beyer, 1987; Bolger and Connoly, 1989; Fifioye and Oluajo, 2006).

The condition factor also expresses the physical and environmental conditions of fish (Le Cren, 1951). It is used for comparing the condition, fatness, or well-being of fish (Tesch, 1968).

In this study, length-weight relationships and relative condition factor (K_{rel}) of *Netuma thalassinus* (Ruppel, 1837), *Parastromateus niger* (Bloch, 1795), *Sillago sihama* (Forsskal, 1775), *Pelates quadrilineatus* (Bloch, 1790), and *Nematolosa nasus* (Bloch, 1795) are presented (this species are abundant in the Persian Gulf) (Figure 2). Results of this study for most species (except *N. nasus*) are reported for the first time from the Persian Gulf waters (Froese and Pauly, 2011).

*Corresponding author. E-mail: moslem.daliri@yahoo.com.

MATERIALS AND METHODS

Study area

The Persian Gulf is a subtropical sea which is separated from the Gulf of Oman by the Strait of Hormuz (Figure 1). The surface area of the Persian Gulf is approximately 2.39 × 105 km^2, and the average depth and volume of the Gulf is 36 m and 8.63 × 103 km^3, respectively (Reynolds, 1993). The study area included Bushehr coastal waters which extends from 50° 6' to 52° 58' E and 27° 14' to 30° 16' N, and covers the fishing grounds of shrimp. Trawling was carried out between depths of 7 to 30 m during June to August 2011 (shrimp fishing season).

Data collection

Sampling was conducted by R/V SHANAK (Outrigger bottom trawler equipped with two bottom trawl nets with 40 and 50 mm mesh size (stretched mesh) in the cod-end and body net,

Figure 1. Map of Persian Gulf showing the study area and 44 sampling sites.

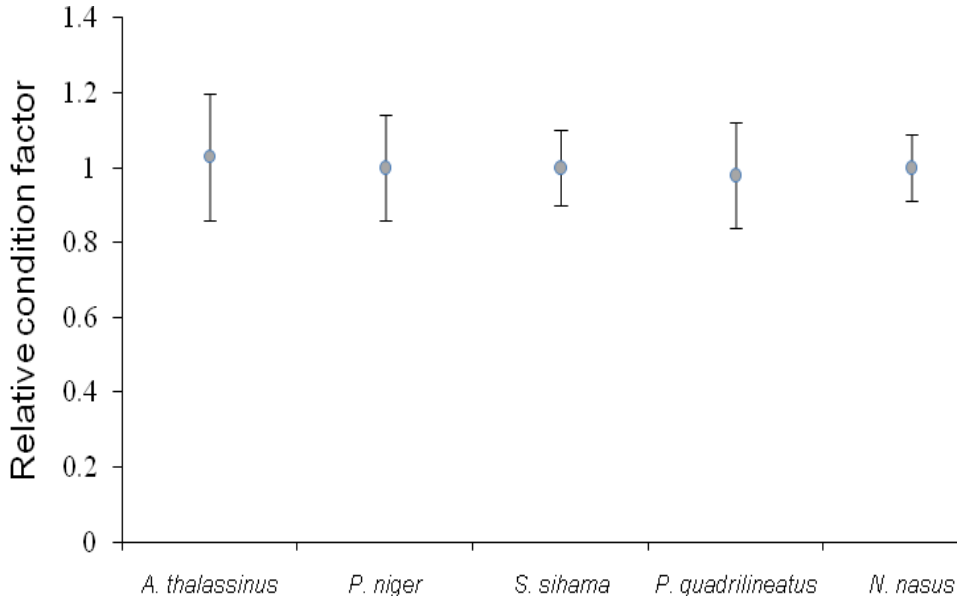

Figure 2. Mean relative condition factor (± SD) of 5 fish species in Bushehr coastal waters (Northern Persian Gulf) during June to August, 2011.

Table 1. The Length characteristics and parameters of the length-weight relationships of five marine fish species in Bushehr coastal waters (Northern Persian Gulf).

Family/Species	Length	N	Length characteristic			Parameter of the relationship			
			Min.	Max.	Mean ± SD	*a*	*b*	95% CL(*b*)	r^2
Ariidae/*N. thalassinus*	FL	67	18.0	64.0	37.48 ± 7.83	0.0175	3.0156	2.9356 - 3.0956	0.92
Carangidae/*P. niger*	FL	73	13.5	43.0	25.95 ± 7.20	0.0342	2.9477	2.7677 - 3.1277	0.93
Sillaginidae/*S. sihama*	TL	123	15.0	23.5	17.86 ± 2.24	0.0176	2.7300	2.4300 - 3.0300	0.85
Teraponidae/*P. quadrilineatus*	TL	98	14.0	29.5	19.17 ± 4.01	0.0208	2.6165	2.5255 - 2.7065	0.96
Clupeidae/*N. nasus*	FL	207	12.5	21.5	17.24 ± 2.20	0.0218	2.5267	2.4807 - 2.5728	0.95

N: number of individuals, FL: fork length, TL: total length, Min. and Max.: minimum and maximum length (cm), SD: standard deviation.

respectively). Sub-samples were collected after each haul and data on length (total length or fork length, cm) and body weight (g) were recorded for each species. The length and weight of fishes were measured to the nearest value (0.1 mm or g) using measuring board and a digital scale, respectively.

Data analysis

For each species, the parameters *a* and *b* of the length-weight relationship was obtained using the linear regression based on logarithmic transformation of the formula (Zar, 1984):

$W = a L^b$

where *W* is the body weight (g) and *L* is the total length or fork length (cm).

The 95% confidence limits (CL) of parameters *b* were calculated. To compare *b* value obtained in the linear regression with isometric value (Sokal and Rohlf, 1987) t-test was also used:

$95\%\ CL = b \pm t_{0.05,\, n-2} . S_b$

where N is the number of specimens.

$$t_s = \frac{(b-3)}{S_b}$$

where t_s is the t-test value, *b* is the slope and S_b the standard error of the slope (*b*). These t-tests allowed the classification of length-weight relationships in isometric (b = 3), negative allometric (b < 3) and positive allometric (b > 3).

For each individual, relative condition factor (K_{rel}) was computed by this equation:

$$K_{rel} = \frac{W}{aL^b}$$

where *W* is the whole body wet weight (g), *L* is the total length or fork length (cm) and *a* and *b* are the parameters of length-weight relationship (Le Cren, 1951).

ANOVA test was used for comparison of relative condition factor (K_{rel}) between caught species.

RESULTS

A total of 568 specimens were measured. The length characteristics and parameters of the length-weight relationships of the selected species are shown in Table 1. All regressions are highly significant (P < 0.01) and the r^2 values range from 0.85 (*S. sihama*) to 0.96 (*P. quadrilineatus*). The mean value of *b* for all species was 2.7673.

The 95% confidence limits (CL) values of exponent *b* for all the species were mostly sets within the range of 2.5 to 3.5. Therefore, these parameters can be securely utilized in the pointed out length range (Froese, 1998).

The growth was isometric for *N. thalassinus* and *P. niger* (*b* = 3, P > 0.05). *S. sihama, P. quadrilineatus* and *N. nasus* showed negative allometric (*b* < 3, P < 0.05). Relative condition factor (K_{rel}) did not differ significantly between species (P > 0.05) and ranged from 0.98 ± 0.14 (for *P. quadrilineatus*) to 1.03 ± 0.17 (for *N. thalassinus*) (Figure 2).

DISCUSSION

This study can be of help to fishery managers of the Persian Gulf, because of the lack of documentation about length-weight relationship of the selected species in the Iranian waters of the Persian Gulf.

Isometric growth (*b* = 3, P > 0.05) in *N. thalassinus* and *P. niger* indicated that the small specimens have the same form and condition as large specimens. Negative allometric growth (*b* < 3, P < 0.05) in *S. sihama*, *P. quadrilineatus* and *N. nasus* also indicated that large specimens changed their body shape to become more elongated or small specimens were in better nutritional condition at the time of sampling

Table 2. The parameters *a* and *b* of the length-weight relationship of selected species in the Fish base.

Species	Location	Length type	Length	Sex	*a*	*b*
N. thalassinus	Kuwait (Bawazeer, 1987)	-	-	Unsexed	0.0088	3.022
	Indonesia; Western region (Pauly et al., 1996)	TL	13.0 - 87.0	Unsexed	0.0097	3.040
P. niger	Indonesia; Pulau sea, South Kalimantan (Hadisubroto and Subani, 1994)	TL	-	Unsexed	0.0625	2.642
	Bangladesh; Bay of Bangal (Mustafa, 1999)	FL	-	Unsexed	0.0211	3.012
	India; Godavary estuary (Rao, 1972)	TL	32.0 - 56.0	Unsexed	0.0100	3.062
	Indonesia; Western region (Pauly et al., 1996)	TL	5.0 - 38.0	Unsexed	0.0073	3.319
S. sihama	India; Palicat lake (Krishnamurthy and Kaliyamurthy, 1978)	TL	4.0 - 10.0	Unsexed	0.0069	3.028
	India; Palicat lake (Krishnamurthy and Kaliyamurthy, 1978)	TL	10.1 - 33.0	Unsexed	0.0041	3.089
	New Caledonia; lagoon (Letourneur et al., 1998)	FL	3.5 - 29.0	Unsexed	0.0059	3.130
P. quadrilineatus	Turkey; Eastern Meditternian (Taskavak and Bilecenoglu, 2001)	TL	7.9 - 12.1	Unsexed	0.0134	2.958
N. nasus	China Main; Daya Bay, Guangdong (Xu et al., 1994)	SL	7.0 - 16.0	Unsexed	0.0108	3.105

SL: Standard length, TL: total length.

(Froese, 2006). In this study, efficient sampling was conducted to include the widest possible range of lengths, which were generally obtained with large samples and non-selective fishing gear. Difference in fish lengths shows that the fish population ranged from small specimens to adult.

The comparison of the *b* values obtained in this study and some previously reported results in other location of the world mostly indicate variation in the *b* values (Table 2). This variation can be affected by sex, gonad maturity, health, season, habitat, nutrition, environmental conditions (such as temperature and salinity), area, degree of stomach fullness, differences in the length range of the caught specimen, and fishing gear (Tesch, 1971; Froese, 2006), although, they are not considered in the present study.

Conclusively, it is suggested that further study should be conducted on the composition of LWRs of both sexes of the caught species. Also, relationship between data of physico-chemical parameter of water (Hydrology data) and the parameters of LWRs should be estimated.

ACKNOWLEDGEMENTS

This study was supported by Gorgan University of Agricultural Sciences and Natural Resources and Iran Shrimp Research Centre (ISRC). The authors thank the crew of R/V SHANAK.

REFERENCES

Beyer JE (1987). On length-weight relationship. Part 1. Correspondingthe mean weight of a given length class. Fishbytes. 5(1):11–13.

Bolger T, Connoly PL (1989). The selection of suitable indices for the measurement and analysis of fish condition. J. Fish Biol. 34:171–182.

Fifioye OO, Oluajo OA (2006). Length-weight relationships of five fish species in Epelagoon, Nigeria. Afr. J. Biotechnol. 4(7):749-751.

Froese R (1998). Length-weight relationships for 18 lessstudied fish species. J. Appl. Ichthyol. 14:117-118.

Froese R (2006). Cube law, condition factor and Length-Weight relationships: history, meta-analysis and recommendations. Appl. Ichthyol. 22:241-253.

Froese R, Pauly D (2011). FishBase. World Wide Web Electronic Publication. Available at http://www.fishbase.org. (accessed on 10 November 2011).

Garcia CB, Buarte JO, Sandoval N, Von Schiller D, Mello NP (1989). Length-weight Relationships of Demersal Fishes from the Gulf of Salamanca, Colombia Fishbyte 21:30–32.

Hadisubroto I, Subani W (1994). The catch and biological aspect of black pomfret (Formio niger) in Kotabaru, south Kalimantan. J. Mar. Fish. Res. (85):95-102. (In Indonesian with English abstract).

Haimovici M, Velasco G (2000). Length-weight relationship of marine fishes from southern Brazil. The ICLARM Q. 23(1):14-16.

Hossain MY, Ahmed ZF, LeundalIslam PM, Islam AKMR, Jasmine S, Oscoz J, Miranda R, Ohtomi J (2006). Length-weight and length-length relationships of some small indigenous fish species from the Mathabhanga River,

southwestern Bangladesh. Appl. Ichthyol. 22:301-303.
Koutrakis ET, Tsikliras AC (2003). Length-weight relationships of fishes from three northern Aegean estuarine systems (Greece). Appl. Ichthyol. 19:258260.
Krishnamurthy KN, Kaliyamurthy M (1978). Studies on the age and growth of sandwhiting *Sillago sihama* (Forsskâl) from Pulicat Lake with observations on its biology and fishery. Indian J. Fish. 25(1&2):84-97.
Le Cren ED (1951). The length–weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). J. Anim. Ecol. 20:201–219.
Letourneur Y, Kulbicki M, Labrosse P (1998). Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update. Naga ICLARM Q. 21(4):39-46.
Moutopoulos DK, Stergiou KI (2002). Length-weight and length-length relationships of fish species from Aegean Sea (Greece). Appl. Ichthyol. 18:200-203.
Mustafa MG (1999). Population dynamics of penaeid shrimps and demersal fin fishes from trawl fishery in the Bay of Bengal and implication for the management. PhD thesis. University of Dhaka, Bangladesh. p. 223.
Pauly D, Cabanban A, Torres FSB (1996). Fishery biology of 40 trawl-caught teleosts of western Indonesia. In D. Pauly and P. Martosubroto (eds.) Baseline studies of biodiversity: the fish resource of western Indonesia. ICLARM Stud. Rev. 23:135-216.
Rao LH (1972). Observations on the biology of *Parastromateus niger* (Bloch) and *Pampus chinensis* (Euphrasen) from the Godavari estuary. J. Inland Fish. Soc. 4:207-209.
Reynolds RM (1993). Physical oceanography of the Gulf, Strait of Hormuz, and the Gulf of Oman: results from the Mitchell Expedition. Mar. Poll. Bul. 27:35-60.
Sokal RR, Rohlf FJ (1987). Introduction to biostatistics, 2nd edn. Freeman Publication, New York. pp. 363.
Taskavak E, Bilecenoglu M (2001). Length-weight relationships for 18 Lessepsian (Red Sea) immigrant fish species from the eastern Mediterranean coast of Turkey. J. Mar. Biol. Assoc. U.K. 81(5):895-896.
Tesch FW (1968). Age and growth. In: Methods for assessment of fish production in fresh waters. Ricker WE (Ed.). Blackwell Scientific Publications. Oxford. pp. 93–123.
Tesch FW (1971). Age and growth. In: Ricker WE ed., Methods for Assessment of Fish Production in Freshwaters, Blackwell Scientific Publications, Oxford. pp. 98-100.
Xu G, Zheng W, Huang G (1994). Atlas of the fishes and their biology in Daya Bay. Anhui Scientific and Technical Publishers, P.R.O.C. pp. 311.
Zar JH (1984). Biostatistical analysis. Prentice Hall, New Jersey. pp. 718.