

Short Communication

Length-weight and length-length relationships of eight fish species from Hara Biosphere Reserve; a mangrove swamp in the Persian Gulf

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Introduction

Length-weight and length-length relationships have important implications for the life history patterns of fish species (Moutopoulos and Stergiou 2002; Froese, 2006). Such data are essential to understanding morphological comparisons among species and populations (Safran, 1992; Moutopoulos and Stergiou 2002; Froese *et al.*, 2011), and are highly significant for fisheries research, management, and conservation (Christensen and Walters, 2004). The present study establishes the LWRs of rare fish species (i.e., jumping

halfbeak, *Hemiramphus archipelagicus*, diamondback puffer, *Lagocephalus guentheri* and short-nosed tripod, *Triacanthus biaculeatus*) for which a little information is available in the region. The reported data for round spadefish, *Ephippus orbis*, gizzard shad, *Nematalosa nasus*, strongspine silver-biddy, *Gerres longirostris*, klunzinger's mullet, *Liza klunzingeri* and northern whiting, *Sillago sihama* could be used to compare fish growth and welfare among different habitats.

Materials and methods

Specimens were collected quarterly from ten mangrove intertidal creeks of

Hara Biosphere Reserve in the northern coast of the Persian Gulf from June 2017 to July 2018 (Fig. 1).

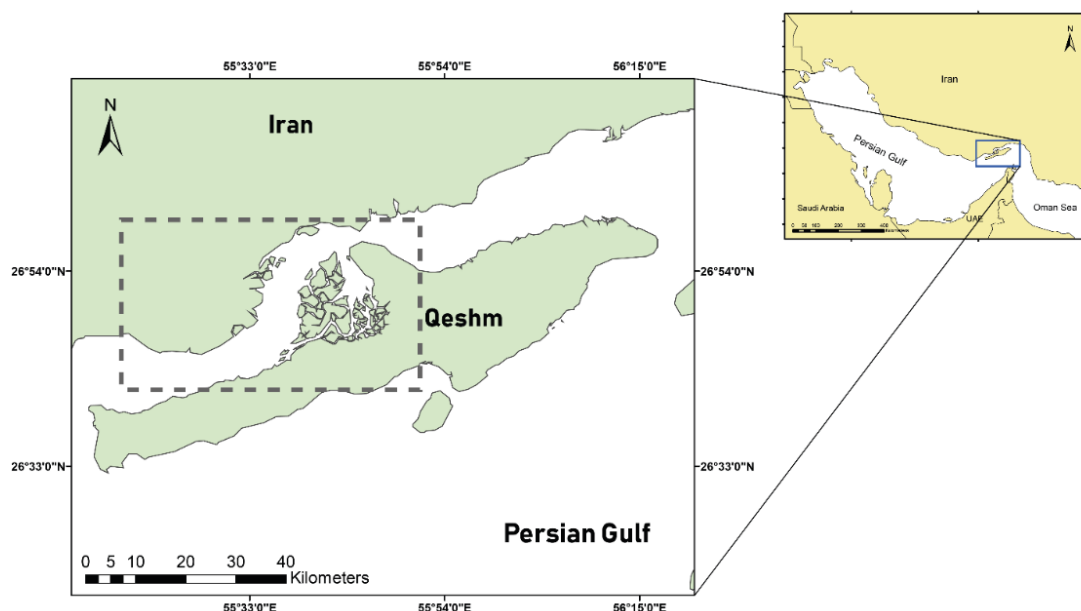


Figure 1: Sampling locations in the Hara Biosphere Reserve off the northern coast of the Persian Gulf, June 2017 to July 2018.

The area is dominated by monospecific stands of *Avicennia marina*, with scattered small patches of planted *Rhizophora mucronata*, which cover a total area of only one km² (Shojaei *et al.*, 2019; Delfan *et al.*, 2020). The specimens were sampled by blocking the creek entrances with a 10 mm-mesh net (20×5 m) and drift gillnet (20 mm stretched mesh size). Samples were identified to species level immediately in the field following Fischer and Bianchi (1984) and Assadi and Dehghani (1997). The total length (TL), standard length (SL) and body weight (Wt) of specimens were measured to the nearest mm and 0.01 g accuracy, respectively. Length-weight

relationship (LWRs) was estimated using the conventional formula $W=a.L^b$ log transformed to a linear model ($\log Wt = \log a + b \times \log TL$); where a is the intercept of the regression curve, and b is the regression coefficient indicating isometric growth when close to three (Froese, 2006). The Student's t-test was used to predict any significant deviation of the b value from the theoretical isometric value (i.e., $b=3$) (Snedecor and Cochran, 1967). The length-length relationship (LLRs) between TL and SL were also established using linear regression analyses. Statistical analyses were performed using the R (R Core Team, 2017).

Results and discussion

In the present observation the b values range from 2.693 (*L. guentheri*) to 3.321 (*H. archipelagicus*) (Table. 1 and Fig. 2). LWRs for all the fish species were found to be significant ($p < 0.01$). The coefficient of determination values (r^2) in all LWRs were > 0.96 and considered acceptable. The values of parameter b for all the eight species were within the expected range of 2.5–3.5 (Froese, 2006). Concerning the type of growth, *T. biaculeatus* and *G. longirostris* showed isometric growth ($p > 0.05$), *H. archipelagicus*, *E. orbis*, *S. sihama*, and *N. nasus* showed positive

allometry ($p < 0.05$) and *L. guentheri*, and *L. klunzingeri* showed negative allometry ($p < 0.05$) (Fig. 1). Small differences in the length-weight relationships of similar species may exist as a result of feeding, temperature or other environmental variables (Hakimelahi *et al.*, 2010). Length–length relationships for TL and SL were found to be highly correlated in most of the species (except for *L. klunzingeri* and *N. nasus*) and are statistically significant ($p < 0.01$) (Table 2). LWRs and LLRs for all species can serve as a baseline for future studies.

Table 1: Descriptive statistics and 95% confidence intervals of a and b for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

Species	N	Total length (cm)		Body Weight (cm)		Regression Parameters	
		Min	Max	Min	Max	95% CI of a	95% CI of b
<i>Hemiramphus archipelagicus</i> (Collette & Parin, 1978)	27	10.6	16.6	3.2	11.9	0.0003 - 0.0026	3.001 - 3.513
<i>Lagocephalus guentheri</i> (Miranda Ribeiro, 1915)	38	6.5	11.5	4.9	22.1	0.023 - 0.046	2.467 - 2.785
<i>Triacanthus biaculeatus</i> (Bloch, 1786)	69	8.2	15.8	4.4	37.4	0.004 - 0.008	3.052 - 3.237
<i>Ephippus orbis</i> (Bloch, 1787)	40	7.3	12	4.1	14.3	0.002 - 0.008	3.018 - 3.324
<i>Sillago sihama</i> (Forsskal, 1775)	92	11	20.2	8.5	53.4	0.005 - 0.018	3.054 - 3.292
<i>Liza klunzingeri</i> (Day, 1888)	121	8.7	14.3	10.9	32.4	0.012 - 0.035	2.578 - 2.805
<i>Nematalosa nasus</i> (Bloch, 1795)	67	9	15.6	7.7	42.5	0.003 - 0.007	3.150 - 3.496
<i>Gerres longirostris</i> (Lacepède, 1801)	46	6.5	14.7	3.3	41.8	0.007 - 0.017	2.657 - 3.208

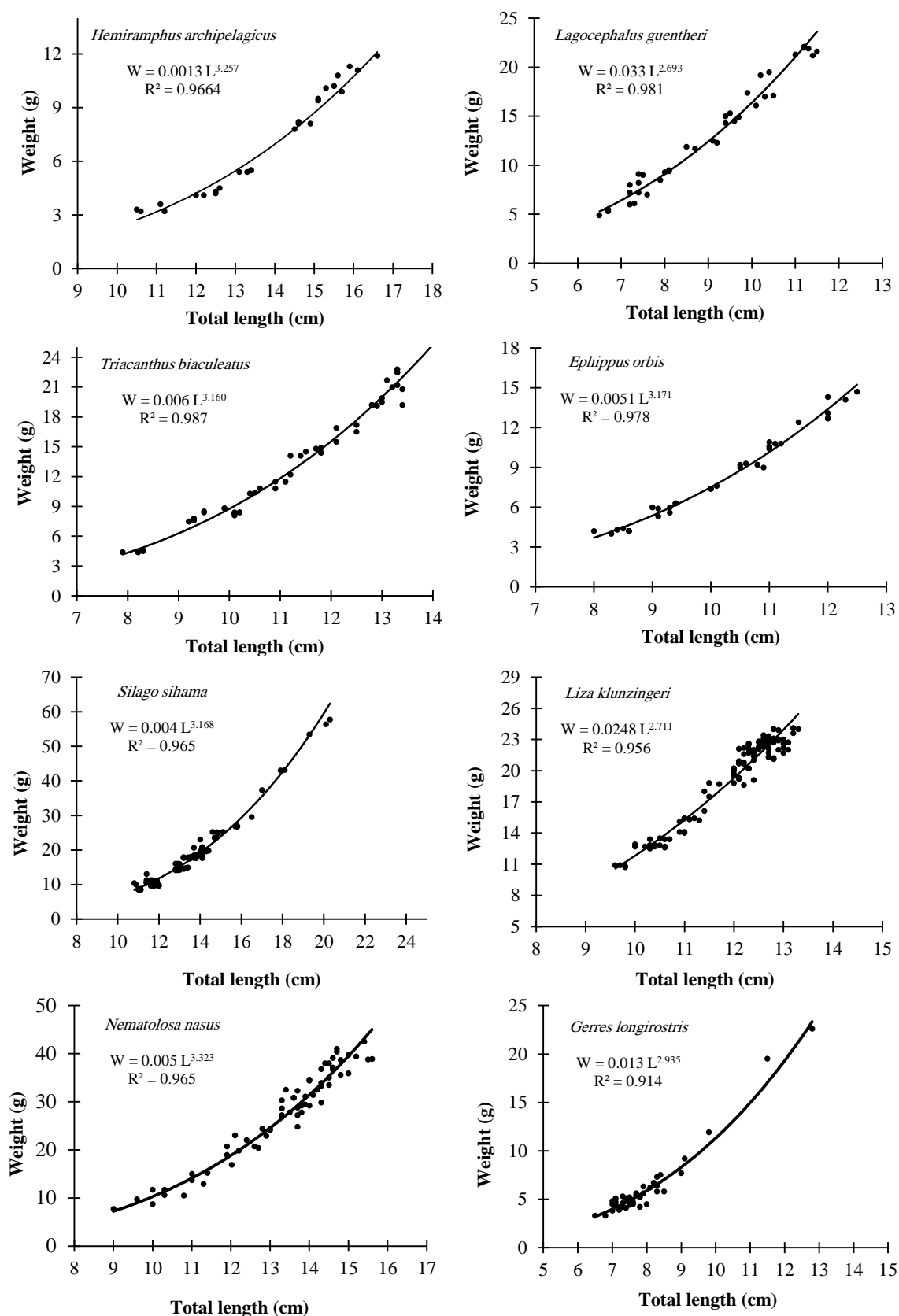


Figure 2: Length weight relationships for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

Table 2: Length-length relationship between total length (TL) and standard length (SL) for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

Species	n	mean length (cm)		Equation (TL=a+bSL)	r ²
		TL	SL		
<i>Hemiramphus archipelagicus</i> (Collette & Parin, 1978)	27	14.09	11.98	TL = - 1.666 + 0.968 SL	0.988
<i>Lagocephalus guentheri</i> (Miranda Ribeiro, 1915)	38	8.77	-	-	-
<i>Triacanthus biaculeatus</i> (Bloch, 1786)	69	11.73	10.26	TL = 0.415 + 0.840 SL	0.990
<i>Ephippus orbis</i> (Bloch, 1787)	40	10.11	9.04	TL = -0.608 + 0.954 SL	0.986
<i>Sillago sihama</i> (Forsskal, 1775)	92	13.74	13.27	TL = -1.019 + 1.040 SL	0.995
<i>Liza klunzingeri</i> (Day, 1888)	121	12.08	11.29	TL = 0.192 + 0.919 SL	0.969
<i>Nematalosa nasus</i> (Bloch, 1795)	67	13.26	11.36	TL = 1.524 + 0.724 SL	0.926
<i>Gerres longirostris</i> (Lacepède, 1801)	141	8.05	7.24	TL = -0.201 + 0.924 SL	0.978

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References

Assadi, H. and Dehghani, R., 1997. Atlas of the Persian Gulf and the Sea of Oman fishes. *Iranian Fisheries Research and Training Organization*, Tehran, 248 P.

Christensen, V. and Walters, C.J., 2004. Ecopath with Ecosim: methods, capabilities, and limitations. *Ecological Modeling*, 172(2-4), 109-139. DOI:10.1016/j.ecolmodel.2003.09.003

Delfan, N., Shojaei, M.G. and Naderloo, R., 2020. Biodiversity and structure of macrozoobenthos communities in the Hara Biosphere Reserve, Persian Gulf, Iran. *Journal of Animal Environment*, 12(2), 373-380.

DOI:10.22034/AEJ.2020.107487

Fischer, W. and Bianchi, G., 1984. FAO species identification sheets for fishery purposes: Western Indian Ocean; (Fishing Area 51). Rome: Food and Agricultural Organization.

Froese, R., 2006. Cube law, condition factor, and weight-length relationships: history, meta-analysis, and recommendations. *Journal of Applied Ichthyology*, 22(4), 241-253. DOI:10.1111/j.1439-0426.2006.00805.x

Froese, R., Tsikliras, A.C. and Stergiou, K.I., 2011. Editorial note on weight-length relations of fishes. *Acta Ichthyologica et*

- Piscatoria*, 41(4), 261-263.
DOI:10.3750/AIP2011.41.4.01.
- Hakimelahi, M., Kamrani, E., Taghavimotlagh, S.A., Shojaei, M.G. and Vahabnezhad, A., 2010.** Growth parameters and mortality rates of *Liza klunzingeri* in the Iranian waters of the Persian Gulf and Oman Sea, using Length Frequency Data. *Iranian Journal of Fisheries Science*, 9(1), 87 – 96.
DOI:10.22092/IJFS.2018.120058.
- Moutopoulos, D.K. and Stergiou, K.I., 2002.** Length–weight and length–length relationships of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyology*, 18(3), 200-203.
DOI:10.1046/j.1439-0426.2002.00281.x
- R Core Team, 2017.** R: A language and environment for statistical computing. R Found. Stat. Comput. Vienna, Austria. URL: <http://www.R-project.org>.
- Safran, P., 1992.** Theoretical analysis of the weight-length relationship in fish juveniles. *Marine Biology*, 112(4), 545-551.
DOI:10.1007/BF00346171
- Shojaei, M.G., Taheri Mirghaed, A., Mshhadi Farahani, M., Delfan, N. and Weigt, M., 2019.** The role of primary productions of *Avicenia marina* in the diet of *Thryssa setirostris* in Hara Biosphere Reserve mangrove ecosystem using stable carbon and nitrogen isotopes. *Journal of Fisheries Science and Technology*, 8(3), 175-181.
- Snedecor, G.W. and Cochran, W.G., 1967.** Statistical methods. *Iowa State University, Ames*, 593 P.