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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).

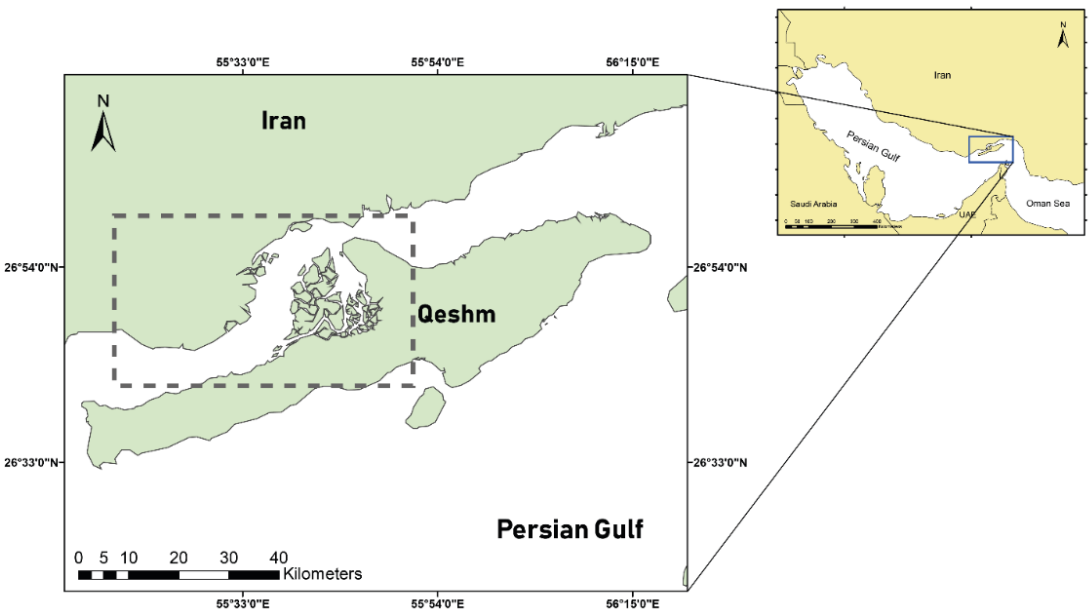

Figure 1: Sampling locations in the Hara Biosphere Reserve off the northern coast of the Persian Gulf, June 2017 to July 2018.

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 km^2 (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 ap+b×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).

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

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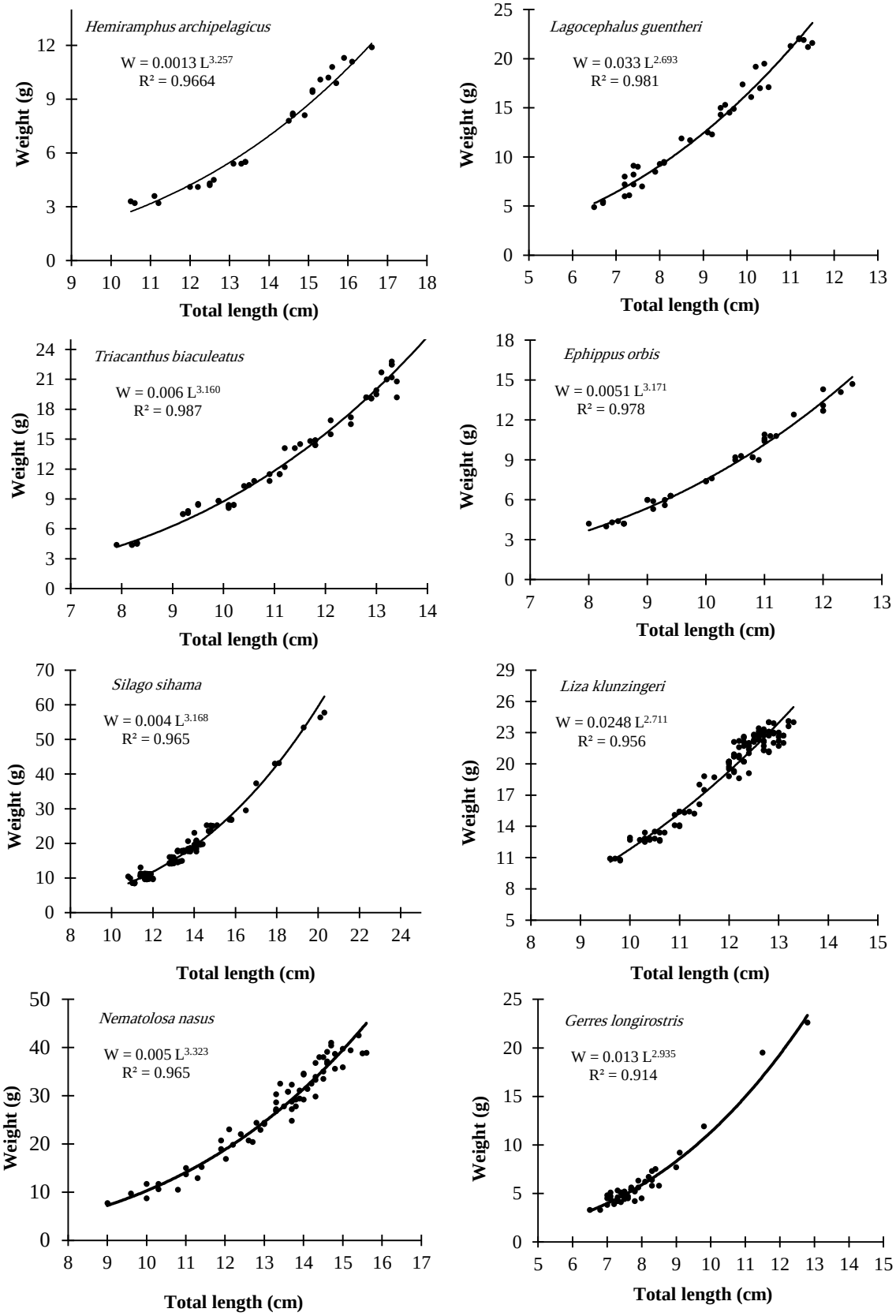

Figure 2: Length weight relationships for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

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

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