LENGTH–WEIGHT AND LENGTH–LENGTH RELATIONSHIPS OF SIX PONYFISH SPECIES FROM THE PERSIAN GULF

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ABSTRACT

Length−weight relationship (LWR) and length−length relationship (LLR) were estimated for six species of ponyfishes captured in the Persian Gulf, Iran. The LWRs indicated isometric growth in ornate ponyfish (*Equulites lineolatus*), common ponyfish (*Leiognathus equulus*) and deep pugnose ponyfish (*Secutor ruconius*) species, positive allometric growth in striped ponyfish (*Aurigequula fasciata*) and negative allometric growth in decorated ponyfish (*Nuchequula gerreoides*) and orangefin ponyfish (*Photopectoralis bindus*). LWR and LLR parameters for one of the species (*E. lineolatus*) are given for the first time. The relationships between TL, FL and SL were all linear and highly correlated (for all cases: $r^2 > 0.97$).

How to Cite

INTRODUCTION

Leiognathidae species, commonly known as ponyfishes or slipmouths, are small bioluminescent, schooling fishes common in near-shore and estuarine in Indo-Pacific waters (McFall-Ngai and Dunlap, 1983; Woodland et al., 2001). Except common ponyfish *Leiognathus equulus* which is relatively big in size and is commercially valuable, other ponyfish species in the Persian Gulf are small in body size and they are usually caught as by-catch in trawl or weir nets, and generally used for fishmeal production.

Length-weight relationship (LWR) and length-length relationship (LLR) parameters have basic uses in fish stock assessment and fisheries management (Froese, 2006). For the Persian Gulf noncommercial species, the number of such studies is very limited (Naderi et al., 2013; Zare et al., 2013) and there are no previous reports for LWR or LLR relationships in ponyfish species from the Persian Gulf. This paper provides the first published reference of the length-weight and length-length relationships for ornate ponyfish (*Equulites lineolatus*) and also the first report for other five ponyfish species from the Persian Gulf.

MATERIALS AND METHODS

Fish specimens were captured from the northern coast of the Persian Gulf in the Strait of Hormuz. Totally, 859 specimens were collected between autumn 2013 and winter 2014 by shrimp beam trawl and weirs nets as by-catch.

All specimens were identified to species level according to Mansor et al. (1998) and Woodland et al. (2001), and re-checked against FishBase (Froese and Pauly, 2014). Total length (TL), standard length (SL) and fork length (FL) were measured to the nearest 0.01 mm with a digital caliper. Weights (W) were measured to the nearest 0.01 g with an electronic balance. Specimens were catalogued and deposited in the Aquatic Animal collection of Tarbiat Modares University.

For visual inspection of outliers, log-log plots of length and weight values were performed and only extreme outliers attributed to data error were omitted from analyses (Froese, 2006). Linear regression applied for LLR estimation including SL vs. TL; SL vs. FL; and TL vs. FL relationships (Hossain et al., 2006). The LWR was calculated by applying the exponential regression equation $W = a L^b$, where W is the total weight (g), L is the total length (cm), a the intercept and b

the slope of log-transformed linear regression (Bagenal and Tesch, 1978).

RESULTS AND DISCUSSION

LWRs of the six species from the Leiognathidae family are given in Table 1, showing that linear regressions on log transformed data were highly significant (P < 0.001), with r^2 > 0.93.

LWRs indicated a negative allometric growth for *N. gerreoides* and *P. bindus*, a positive allometric growth for *A. fasciata* and an isometric growth for *E. lineolatus*, *L. equulus* and *S. ruconius*.

Also, results indicated that the LLRs among the three length measurements were highly correlated (Table 2; P < 0.001; r^2 > 0.97).

A number of factors are known to influence length-weight relationship in fishes, including growth phase, season, sex, habitat and environmental conditions, degree of stomach fullness, gonad maturity, size range and preservation techniques (Tesch, 1971; Wootton, 1990; Alavi-Yeganeh et al., 2011), all of which were not considered in the present study. No previous LWR report was available for *Equulites lineolatus* but LWRs and LLRs for the other five ponyfish species

Table 1. Descriptive statistics and estimated parameters of length-weight relationships (W = a TL^b) for six ponyfish species caught in the Strait of Hormuz, Persian Gulf, Iran

Species	n	TL range (cm)	W range (g)	a	95% CI of a	b	95% CI of b	r^2
Equulites lineolatus	139	4.96-11.34	0.66-10.19	0.006	0.004-0.009	3.144	2.943-3.353	0.931
Aurigequula fasciata	221	5.79-13.06	3.07-36.76	0.010	0.008-0.012	3.249	3.161-3.336	0.980
Secutor ruconius	69	4.33-6.12	1.38-4.10	0.023	0.017-0.032	2.833	2.642-3.024	0.964
Photopectoralis bindus	239	4.41-10.79	1.06-18.98	0.017	0.016-0.019	2.934	2.889-2.980	0.993
Leiognathus equulus	22	9.44-22.09	14.11-236.74	0.010	0.007-0.015	3.216	2.912-3.519	0.997
Nuchequula gerreoides	169	6.86-11.36	4.44-18.02	0.023	0.018-0.029	2.794	2.676-2.912	0.964

n, number of individuals; TL, total length; W, weight; a, intercept; b, slope; CI, confidence intervals; r^2, coefficient of determination.

Table 2. Length-length relationship (Y = a + b X) comparisons of total length (TL), fork length (FL) and standard length (SL) of six ponyfish species in the Strait of Hormuz, Persian Gulf, Iran

Species	n	Equation	a	b	95% CI of b	r^2
Equulites lineolatus	139	TL = a + b SL	0.473	1.212	1.196-1.229	0.997
		SL = a + b FL	-0.885	0.930	0.916-0.943	0.996
		FL = a + b TL	1.148	0.878	0.867-0.890	0.994
Aurigequula fasciata	221	TL = a + b SL	3.235	1.189	1.173-1.206	0.995
		SL = a + b FL	-1.000	0.928	0.916-0.940	0.996
		FL = a + b TL	-0.657	0.891	0.877-0.905	0.993
Secutor ruconius	69	TL = a + b SL	-1.754	1.269	1.213-1.325	0.984
		SL = a + b FL	2.516	0.862	0.815-0.908	0.977
		FL = a + b TL	1.805	0.856	0.808-0.905	0.974
Photopectoralis bindus	239	TL = a + b SL	0.767	1.224	1.213-1.235	0.998
		SL = a + b FL	-0.512	0.922	0.915-0.929	0.992
		FL = a + b TL	0.296	0.880	0.873-0.888	0.998
Leiognathus equulus	22	TL = a + b SL	7.786	1.153	1.126-1.181	0.999
		SL = a + b FL	-1.862	0.932	0.901-0.964	0.999
		FL = a + b TL	-5.196	0.930	0.908-0.952	0.999
Nuchequula gerreoides	169	TL = a + b SL	7.190	1.116	1.077-1.156	0.974
		SL = a + b FL	-0.496	0.922	0.888-0.955	0.973
		FL = a + b TL	-1.584	0.912	0.893-0.932	0.990

n, number of individuals; a, intercept; b, slope; r^2, coefficient of determination, CI, confidence intervals; TL, total length; FL, fork length; SL, standard length.

studied here are also available in the fishbase (Froese and Pauly, 2014). Almost all previous fishbase listings for these species represent without confidence intervals for *a* and *b*. In addition, results were based on an insufficient number or samples not indicated. These problems preclude a direct comparison with the present study. Nevertheless, in few comparable studies, the b values were generally in agreement with results for *A. fasciata* (Kulbiki et al., 2005; b = 3.102), *P. bindus* (Murty, 1983; b = 2.962) and *S. rocunius* (Kulbiki et al., 2005; b = 2.968) from other geographical areas.

In conclusion, this study provides information on the LLRs and LWRs of six ponyfish species captured in the Hormuz Strait of the Persian gulf in Iran. Our results would be useful for fishery biologists and managers in the Persian Gulf area.

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Sažetak

DUŽINSKO-MASENI ODNOS I ODNOS DUŽINA-DUŽINA KOD ŠEST VRSTA RIBA IZ PERZIJSKOG ZALJEVA

Dužinsko-maseni odnos (LWR) i odnos dužina-dužina (LLR) procijenjene su na šest vrsta riba ulovljenih u Perzijskom zaljevu, Iran. Dužinsko-masenim odnosom ustanovljen je izometrijski rast kod vrsta *Equulites lineolatus*, *Leiognathus equulus* i *Secutor ruconius*, pozitivni alometrijski rast kod Aurigequula fasciata i negativan alometrijski rast kod *Nuchequula gerreoides* i *Photopectoralis bindus*. LWR i LLR parametri vrste *E. lineolatus* prikazani su po prvi put. Odnosi između TL, FL i SL su linearni i visoko korelirani (za sve slučajeve: r²> 0,97).

Ključne riječi: Leiognathidae, LWR, LLR, alometrijski rast

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