Short Communication

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

Taheri Mirghaed A.1*; Ghodrati Shojaei M.2; Taghavimotlagh S.A.3; Mashhadi Farahani M.2; Weigt M.4

1-Department of Aquatic Animal Health, Faculty of Veterinary Medicine, University of Tehran, Tehran, 1419963111, Iran.
2-Department of Marine Biology, Faculty of Natural Resources and Marine Sciences, Tarbiat Modares University, 4641776489, Noor, Iran.
3-Iranian Fisheries Science Research Institute, Agricultural Research, Education and Extension, Organization, Tehran, Iran
4- Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany
*Corresponding author: mirghaed@ut.ac.ir

Keywords: Length-weight relationship, Fish, Mangrove

Received: July 2019 Accepted: December 2019

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, *Hemirampus 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).

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 $W = aL^b$ log transformed to a linear model ($\log Wt = \log ap + b \times \log TL$); 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.

<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>Total length (cm)</th>
<th>Body weight (cm)</th>
<th>Regression Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>Hemiramphus archipelagicus (Collette &amp; Parin, 1978)</td>
<td>27</td>
<td>10.6</td>
<td>16.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Lagocephalus guentheri (Miranda Ribeiro, 1915)</td>
<td>38</td>
<td>6.5</td>
<td>11.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Triacanthus biaculeatus (Bloch, 1786)</td>
<td>69</td>
<td>8.2</td>
<td>15.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Ephippus orbis (Bloch, 1787)</td>
<td>40</td>
<td>7.3</td>
<td>12.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Sillago sihama (Forsskál, 1775)</td>
<td>92</td>
<td>11.0</td>
<td>20.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Liza klunzingeri (Day, 1888)</td>
<td>121</td>
<td>8.7</td>
<td>14.3</td>
<td>10.9</td>
</tr>
<tr>
<td>Nematalosa nasus (Bloch, 1795)</td>
<td>67</td>
<td>9.0</td>
<td>15.6</td>
<td>7.7</td>
</tr>
<tr>
<td>Gerres longirostris (Lacepède, 1801)</td>
<td>46</td>
<td>6.5</td>
<td>14.7</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Figure 2: Length weight relationships for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

- *Hemiramphus archipelagicus*
  
  \[ W = 0.0013 L^{3.257} \]
  
  \[ R^2 = 0.9664 \]

- *Lagocephalus guentheri*
  
  \[ W = 0.033 L^{2.693} \]
  
  \[ R^2 = 0.981 \]

- *Triacanthus biaculeatus*
  
  \[ W = 0.006 L^{3.160} \]
  
  \[ R^2 = 0.987 \]

- *Ephippus orbis*
  
  \[ W = 0.0051 L^{3.171} \]
  
  \[ R^2 = 0.978 \]

- *Silago sihama*
  
  \[ W = 0.004 L^{3.168} \]
  
  \[ R^2 = 0.965 \]

- *Liza klunzingeri*
  
  \[ W = 0.0248 L^{2.711} \]
  
  \[ R^2 = 0.956 \]

- *Nematolosa nasus*
  
  \[ W = 0.005 L^{3.323} \]
  
  \[ R^2 = 0.965 \]

- *Gerres longirostris*
  
  \[ W = 0.013 L^{2.935} \]
  
  \[ R^2 = 0.914 \]
Table 2: Length-length relationship between total length (TL) and standard length (SL) for eight fishes from Hara Biosphere Reserve mangrove swamp, Persian Gulf.

<table>
<thead>
<tr>
<th>Species</th>
<th>n</th>
<th>mean length (cm)</th>
<th>Equation (TL=a+bSL)</th>
<th>r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemiramphus archipelagicus (Collette &amp; Parin, 1978)</td>
<td>27</td>
<td>14.09 11.98</td>
<td>TL = -1.666 + 0.968 SL</td>
<td>0.988</td>
</tr>
<tr>
<td>Lagocephalus guentheri (Miranda Ribeiro, 1915)</td>
<td>38</td>
<td>8.77</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triacanthus biaculeatus (Bloch, 1786)</td>
<td>69</td>
<td>11.73 10.26</td>
<td>TL = 0.415 + 0.840 SL</td>
<td>0.990</td>
</tr>
<tr>
<td>Ephippus orbis (Bloch, 1787)</td>
<td>40</td>
<td>10.11 9.04</td>
<td>TL = -0.608 + 0.954 SL</td>
<td>0.986</td>
</tr>
<tr>
<td>Sillago sihama (Forsskål, 1775)</td>
<td>92</td>
<td>13.74 13.27</td>
<td>TL = -1.019 + 1.040 SL</td>
<td>0.995</td>
</tr>
<tr>
<td>Liza klunzingeri (Day, 1888)</td>
<td>121</td>
<td>12.08 11.29</td>
<td>TL = 0.192 + 0.919 SL</td>
<td>0.969</td>
</tr>
<tr>
<td>Nematalosa nasus (Bloch, 1795)</td>
<td>67</td>
<td>13.26 11.36</td>
<td>TL = 1.524 + 0.724 SL</td>
<td>0.926</td>
</tr>
<tr>
<td>Gerres longirostris (Lacepède, 1801)</td>
<td>141</td>
<td>8.05 7.24</td>
<td>TL = -0.201 + 0.924 SL</td>
<td>0.978</td>
</tr>
</tbody>
</table>

Acknowledgements
We would like to acknowledge the fishermen of the Qeshm and Bandar Khamir for their support in sample collection. We also thank Nastaran Delfan and Hamed Bazmandegan for help with fieldwork. This work was supported by the “Center for International Science studies and Collaboration” (Iran) (Grant no. 484).

References


