The Biometric Analysis of Pipefish Species from Çamaltı Lagoon (İzmir Bay, Aegean Sea)*

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Introduction

The biometric variations are important for the descriptions of species. Morphological characters, such as body shape and meristic counts, have long been used to stocks identifications (Turan et al., 2004). As a rule, specimens originating from different areas differ from one another in morphology (Franičević et al., 2005). Fishes of the family Syngnathidae usually associated with vegetated or other complex epibenthic habitats (Lounge et al., 1999; Kuiter, 2000) is a cryptic species that can adapt to changes in the environment (Pollard, 1984). These highly specialised fishes are characterised by limited mobility due to the small size and their fins and the occurrence on their bodies of semi-rigid dermal plates that restrict flexibility (Kendrick & Hydnes, 2005). The morphological characters in some pipefish species (Syngnathus fuscus, Syngnathus floridae, Syngnathus abaster, Syngnathoides biaculeatus, Nerophis ophidion, Stigmatopora argus and Stigmatopora nigra) from different areas were described by Teixera & Musick (1995), Cakić et al. (2002), Takahashi et al. (2003), Margonski (1990) and Kendrick & Hydnes (2005) using morphometric approach. The family Syngnathidae consist of 2 pipefish genera, which comprise 6 species distributed in Izmir Bay, Aegean Sea (Syngnathus typhle, Syngnathus acus, Syngnathus abaster, Syngnathus tenuirostris, Syngnathus ptyhelogn, Nerophis ophidion) (Kence and Bilgin, 1996). And they have not commercial importance in fisheries but significantly sound management of vegetated coastal resources relies on basic knowledge of the biology of the species, including information on population structure. In this research aimed to determined the variation of meristic and morphometric characters of three pipefish caugth in the coasts of İzmir Bay, Aegean Sea. Also this research is preliminary study about pipefish biometric characters in the our region.

Material and Methods

562 individuals of pipefish were obtained by monthly beach seine net (1 mm mesh size, 120 cm x 1200 cm) samplings conducted in the vicinity of Çamaltı Lagoon, İzmir Bay, in 2000-2002 (Fig.1). Total length measured (TL, mm) was taken. Sex was determined macroscopically. A morphometric and meristic characters were measured on the individuals.

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The morphometric characters; TL: total length, BH: body height, BW: body width, OHH: opisthocranion height of the head, HL: head length, MH: mouth height, MW: mouth width, ED: eye diameter, DFL: dorsal fin length, PFL: pectoral fin length, and meristic characters DRN: dorsal fin ray number, PRN: pectoral fin ray number, CRN: caudal fin ray number, PR: preanal ring number, Po: postanal ring number. To test the difference of the morphometric characters in males and females of all species the ANOVA Tukey-one way variance test was used. And to test the in the meristic characters the Kolmogrov-Smirnov test was applied (Sokal and Rohlf, 1981).

The morphometric and meristic characters of Syngnathus acus are given in Table 2. The values of the 10 morphometric and 5 meristic characters of S. typhle are given in Table 2. Kolmogrov Simirnov test did not reveal any statistically significant difference between females and males in the morphometric characters (p>0.05). The morphometric characters were found to be greater in females than in males in terms of the statistical significance (Tukey one-way variance test, p=0.00); the mouth width (df: 1-70, F: 5.582, p=0.02), mouth height (1-70 F: 6.28, p=0.002), eye dimension (df: 1-70 F: 19.082, p=0.00) and the length of the dorsal fin base (df: 1-70 F: 13.49, p=0.00).

The values of the morphometric and meristic characters of N. ophidion given in Table 3. Pectoral and caudal fins are absent in N. ophidion. So, nine morphometric and three meristic characters were determined. The total length were significantly greater in females than males (df: 1-73 F: 6.781, p=0.01).

No statistically significant difference in the meristic characters in females and males of the Nerophis ophidion were found (Kolmogorov-Smirnov two way similarity test). The statistically significant differences between females and males of N. ophidion were revealed for the eye dimension in females (df: 1-78, F: 4.386, p= 0.048) which was greater in males.

<table>
<thead>
<tr>
<th>Morphometric characters</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean ±SE</td>
<td>Min-Max</td>
</tr>
<tr>
<td>TL</td>
<td>235</td>
<td>111.47±1.60</td>
</tr>
<tr>
<td>BH</td>
<td>83</td>
<td>3.14±0.09</td>
</tr>
<tr>
<td>BW</td>
<td>83</td>
<td>2.98±0.11</td>
</tr>
<tr>
<td>OOH</td>
<td>83</td>
<td>2.91±0.16</td>
</tr>
<tr>
<td>HL</td>
<td>82</td>
<td>12.48±0.40</td>
</tr>
<tr>
<td>MH</td>
<td>83</td>
<td>0.90±0.05</td>
</tr>
<tr>
<td>MW</td>
<td>83</td>
<td>1.04±0.03</td>
</tr>
<tr>
<td>ED</td>
<td>83</td>
<td>1.23±0.05</td>
</tr>
<tr>
<td>DFL</td>
<td>83</td>
<td>10.88±0.35</td>
</tr>
<tr>
<td>PFL</td>
<td>70</td>
<td>1.56±0.05</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Meristic characters</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean ±SE</td>
<td>Min-Max</td>
</tr>
<tr>
<td>DRN</td>
<td>13</td>
<td>29.92±0.53</td>
</tr>
<tr>
<td>PRN</td>
<td>5</td>
<td>10±0.45</td>
</tr>
<tr>
<td>CRN</td>
<td>13</td>
<td>7.77±0.72</td>
</tr>
<tr>
<td>PR</td>
<td>106</td>
<td>16.83±0.07</td>
</tr>
<tr>
<td>Po:RN</td>
<td>106</td>
<td>38.72±0.13</td>
</tr>
</tbody>
</table>

* significantly different at p<0.05
Discussion

In this preliminary study, data presented indicate that specimens of three pipefish have diverged in morphology. Differences in meristic and morphometric variations by sexes could be related to the procedures for sampling, sample size. The researches of pipefish morphology focused on head features, except Çaki et al. (2002) who studied morphometric characteristics mainly related to head and mouth features. Syngnathids in general exhibit a high degree of trophic specialization compared to many other epibenthic or demersal marine teleosts (Hydnes et al., 1997). The trophic specialization occurs between different syngnathid species and especially their snout morphologies and feeding behaviour (Kendrick & Hydnes, 2005).

In this study demonstrates the existence of morphometric variations between species and sexes in three pipefishes. The mean mouth width and mouth height values of Syngnathus typhle (mean MW: 0.78, mean MH: 0.85) were determined to be shorter in Syngnathus typhle while S. typhle’s had a greater measurement (mean MW: 1.08, mean MH: 1.51). In this study demonstrates the existence of morphometric variations between species and sexes in three pipefishes.

### Table 2. Morphologic and meristic characters of Syngnathus typhle.

<table>
<thead>
<tr>
<th>Morphometric characters</th>
<th>Females</th>
<th>Males</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>N: 70</td>
<td>171.2±5.11</td>
<td>19-302</td>
</tr>
<tr>
<td>BH</td>
<td>47</td>
<td>3.69±0.16</td>
<td>2.1-6.84</td>
</tr>
<tr>
<td>BW</td>
<td>47</td>
<td>3.95±0.19</td>
<td>2.2-7.73</td>
</tr>
<tr>
<td>OOH</td>
<td>47</td>
<td>4.1±0.17</td>
<td>2.7-7.46</td>
</tr>
<tr>
<td>HL</td>
<td>47</td>
<td>29.51±0.10</td>
<td>17.01-46.71</td>
</tr>
<tr>
<td>MH</td>
<td>47</td>
<td>1.74±0.09</td>
<td>0.68-2.82</td>
</tr>
<tr>
<td>MW</td>
<td>47</td>
<td>1.21±0.05</td>
<td>0.71-2.16</td>
</tr>
<tr>
<td>ED</td>
<td>47</td>
<td>1.74±0.05</td>
<td>1.15-2.63</td>
</tr>
<tr>
<td>DFL</td>
<td>47</td>
<td>17.70±0.95</td>
<td>10.91-26.32</td>
</tr>
<tr>
<td>PFL</td>
<td>33</td>
<td>1.73±0.05</td>
<td>1.22-2.55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meristic characters</th>
<th>Females</th>
<th>Males</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRN</td>
<td>N: 2</td>
<td>31±1.0</td>
<td>30-32</td>
</tr>
<tr>
<td>PRIN</td>
<td>1</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>DRIN</td>
<td>4</td>
<td>9±1.0</td>
<td>8-10</td>
</tr>
<tr>
<td>PR: RN</td>
<td>10</td>
<td>18.40±0.31</td>
<td>17-20</td>
</tr>
<tr>
<td>Po: RN</td>
<td>10</td>
<td>34.80±0.83</td>
<td>30-38</td>
</tr>
</tbody>
</table>

* significantly different at p<0.05

### Table 3. Morphologic and meristic characters of Nerophis ophidian.

<table>
<thead>
<tr>
<th>Morphometric characters</th>
<th>Females</th>
<th>Males</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>N: 50</td>
<td>155.59±0.87</td>
<td>103-214</td>
</tr>
<tr>
<td>BH</td>
<td>26</td>
<td>1.55±0.06</td>
<td>1.02-2.61</td>
</tr>
<tr>
<td>BW</td>
<td>25</td>
<td>0.35±0.07</td>
<td>1.16-2.33</td>
</tr>
<tr>
<td>OOH</td>
<td>23</td>
<td>2.06±0.43</td>
<td>1.47-3.01</td>
</tr>
<tr>
<td>HL</td>
<td>25</td>
<td>9.52±0.27</td>
<td>7.96-12.94</td>
</tr>
<tr>
<td>MH</td>
<td>23</td>
<td>0.83±0.06</td>
<td>0.30-1.28</td>
</tr>
<tr>
<td>MW</td>
<td>25</td>
<td>0.89±0.05</td>
<td>0.60-1.36</td>
</tr>
<tr>
<td>ED</td>
<td>24</td>
<td>0.20±0.04</td>
<td>0.64-1.37</td>
</tr>
<tr>
<td>DFL</td>
<td>18</td>
<td>14.98±0.48</td>
<td>12.01-20.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meristic characters</th>
<th>Females</th>
<th>Males</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRN</td>
<td>N: 2</td>
<td>37.50±0.50</td>
<td>37-38</td>
</tr>
<tr>
<td>PR: RN</td>
<td>6</td>
<td>28.33±0.96</td>
<td>25-51</td>
</tr>
<tr>
<td>Po: RN</td>
<td>6</td>
<td>56±4.70</td>
<td>42-70</td>
</tr>
</tbody>
</table>

* significantly different at p<0.05

The fact that our results for *S. acus* are unlike Bozkurt (1955) may be due to the lower water temperatures affecting embryonic stage of the populations in our area. Few researchers have described of morphometric and meristic characters of pipefish species (Margonski 1990; Kendrick & Hydnes 2005). Snout morphology is the important character that differed between this and other studies.

The results showed that the three pipefish species significantly differentiated in some morphometric characters (snout features, the dorsal fin length, eye dimension etc.) and meristic characters (preanal and postanal ring number etc.) in sexes. The biometric results in this paper are preliminary and provide an insight into distinguishing among pipefish species that might be use and further and more complex research combining morphological and genetic research are required. So, the need for detailed genetic research in order to provide evidence about the relationships among different populations of pipefish.

References


