

The diet and food consumption of whiting  
*Merlangius merlangus merlangus* (Linne) 1758  
in the Sea of Marmara

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**Abstract:**

The stomachs ~ 1,000 of *Merlangius merlangus merlangus* (Linne) 1758 were examined in period of 2000 to 2005. The contents of the mentioned stomachs (approximately 800) were analyzed. Almost 42% were empty or have lost their contents during or before landing through regurgitation. Arthropoda and fish comprised nearly 79% by weight of the stomach contents of *M.m. merlangus* of all sizes and seasons.

Some seasonal and geographical differences in stomach contents of *M.m. merlangus* were detected. Annelids represented a significant proportion of the food of *M.m. merlangus* in the east part of Sea of Marmara (especially high urbanized parts of Sea of Marmara), in the north part (north of the line between Tekirdag and Karabiga) is the 21% content are dominant the cephalopod molluscs, during the whole year. The 18-22% part at the whole stomach contents was fine sediment from bottom.

The stomach of the prepared fish with their stomach content was recorded as total yield. ( $W_R = 0.0023$ ).

**Key words:** Diet, Food consumption, *Merlangius merlangus merlangus*

**Material-methods:**

*Merlangius merlangus merlangus* (Linne) 1758 were sampled at purse-seine fishers and fishing tournaments in Sea of Marmara between 2000 and 2005. Intact stomachs were removed by cutting above the esophagus and below the large intestine. Stomachs were labeled and transported in thermos bag with ice to the laboratory, and examined in relatively fresh condition. The contents of stomachs were emptied onto a 500- $\mu$ m mesh sieve for rinsing and sorting. Samples were prepared for separating organic matter and mud. Mud was precipitated and organic contents were strained, spread out on paper towels before counts and identifications to the lowest possible taxon were made. (*crustacea and fish remains not identifiable to family*)

**Results**

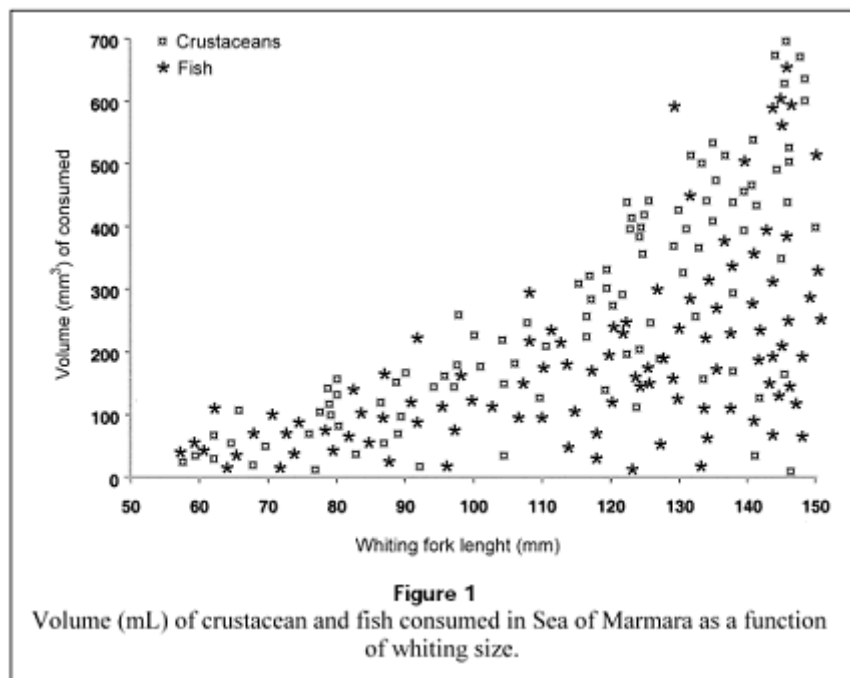
Whiting is distributed in the western Mediterranean Sea, Black Sea, Aegean Sea and Adriatic Sea, where two subspecies are distinguished (Aksiray, 1987). The species is also present in the north-east Atlantic from the northern coast of Portugal to Iceland and the south-western Barents Sea.

Male and female whiting grow very quickly reaching around 12cm. in their first year. After this the growth rate becomes much slower. (Artüz, 2004)

The species is commonly found near the bottom in waters from 10 to 200m, but may move into midwater in the pursuit of its prey (Aksiray, 1987). Stomach contents from 800 adult *M.m. merlangus* (57–149mm. FL) were examined. 464 (58%) contained at least one identifiable, nonbait prey item. Almost 336 stomachs (42%) were empty or have lost their contents during or before landing through regurgitation. One species of rhizopoda, one species of polychaeta, two species of amphipoda, one species of decapoda, one cephalopod and six species of teleost were observed (Figure 2).

Also the rest is recorded in order and suborder level. Mean volume of prey per stomach was 150.6 ml (range: 2–680 ml). Mean number of different prey per stomach was 1.9 species (range, 1–5 species). Larger whiting consumed greater volumes of crustacean. Euphausiids, mysids and crangonid shrimps are dominated in the diet of whiting. Although from the bottom sediment relatively high volumes were observed.

Volume (ml) of crustacean and fish consumed as a function of whiting size is shown in figure 1.



Index of relative importance (IRI) values for arthropoda (incl. larvae) (217) and fish (incl. larvae) (156) were two orders of magnitude higher than IRI values for other prey items.

Some seasonal and geographical differences in stomach contents of *M.m. merlangus* were clearly to detect. Annelids represented a significant proportion of the food of *M.m. merlangus* in the east part of Sea of Marmara (especially high urbanized parts of Sea of Marmara), in the north part (north of the line between Tekirdag and Karabiga) as the 21% pure organic content are dominant the decapoda, during the whole year.

Whiting are active predators. Juvenile fish eat mainly crustaceans. But as whiting grow the amount of fish in their diet increases. The exact composition of the diet depends on the size of the fish, the area and the time of the year.

Whiting feeding habits in Sea of Marmara were more similar to feeding habits reported for whiting from west Black Sea (Artuz, 1995) than to feeding habits of whiting from the Mediterranean (Svetovidov, Bauchot et al. 1986).

Crangonid shrimps are dominated the diet of whiting in Sea of Marmara (Artuz, 1995). Large whittings may be eaten exclusively by elasmobranch fishes in Sea of Marmara (Aksiray, 1954). In eastern part of Sea of Marmara, stingrays (*Dasyatis* sp.) and smooth dogfish (*Mustelus canis*) fed on whittings. (Artuz, 1995)

Until the mid of 1980 it was a cheap fish, regarded as food for the poor or for sick people, because the white and digestable flesh, but the general decline in fish stocks means that it is now more highly valued

Complete list of the diet composition of whiting ( $n= 464$ ; stomachs with contents), *Merlangius merlangus merlangus* from the Sea of Marmara. Values of percent of weight (%W), frequency of occurrence (%O), and weighted resultant index (%Rw) for each food item are tabulated below, in figure 2.

Food items	West Sea of Marmara			East Sea of Marmara		
	%W	%O	%Rw	%W	%O	%Rw
<b>Total ALGAE</b>	<b>0.00</b>	<b>0.07</b>	<b>0.00</b>	<b>0.01</b>	<b>1.09</b>	<b>0.03</b>
<b>Total RHIZOPODA</b>	<b>1.86</b>	<b>3.34</b>	<b>3.03</b>	<b>1.65</b>	<b>3.22</b>	<b>3.99</b>
<i>Noctiluca miliaris</i>	0.02	2.03	0.06	0.25	2.38	0.51
<b>Porifera (un)</b>	<b>0.73</b>	<b>1.01</b>	<b>0.66</b>	<b>0.54</b>	<b>1.12</b>	<b>0.70</b>
<b>Total CNIDARIA</b>	<b>0.02</b>	<b>1.24</b>	<b>0.04</b>	<b>0.27</b>	<b>3.07</b>	<b>0.55</b>
Cnidaria (un)	0.01	1.09	0.03	0.26	2.40	0.53
Hydrozoa (un)	0.01	0.15	0.01	0.01	0.67	0.02
<b>Total WORMS</b>	<b>0.58</b>	<b>5.53</b>	<b>1.21</b>	<b>2.39</b>	<b>12.95</b>	<b>4.43</b>
Nematoda and Nemertini (un)	0.00	0.21	0.86	0.14	1.96	0.25
Polychaeta (un)	0.34	3.38	0.15	1.52	7.20	3.11
Serpulidae (un)	0.17	1.55	0.17	0.17	1.22	0.32
Sipuncula (un)	0.07	0.39	0.03	0.34	2.44	0.65
<i>Eulalia viridis</i>	0.00	0.00	0.00	0.22	0.13	0.10
<b>Total MAXILLOPODA</b>	<b>1.23</b>	<b>6.23</b>	<b>1.45</b>	<b>1.01</b>	<b>5.98</b>	<b>1.33</b>
Cirripedia (un)	1.00	5.00	1.07	0.03	0.01	1.98
Balanidae (un)	0.23	1.23	0.38	0.98	1.11	1.54
<b>Total AMPHIPODA</b>	<b>2.02</b>	<b>0.96</b>	<b>1.98</b>	<b>0.98</b>	<b>0.55</b>	<b>1.04</b>
Gammaridea (un)	1.03	0.76	1.12	0.66	0.12	0.97
<i>Tritaeta gibbosa</i>	0.64	0.12	0.44	0.00	0.02	0.00
<i>Dexamine spiniventris</i>	0.35	0.08	0.42	0.00	0.01	0.00
<b>Total ISOPODA</b>	<b>1.18</b>	<b>5.72</b>	<b>2.16</b>	<b>0.75</b>	<b>4.34</b>	<b>1.98</b>
Diptera (un)	0.88	2.44	3.56	0.00	0.01	0.00
<b>Total DECAPODA</b>	<b>41.03</b>	<b>22.35</b>	<b>34.71</b>	<b>40.68</b>	<b>21.65</b>	<b>37.95</b>
Decapoda (un)	9.03	2.04	8.34	9.13	1.98	9.08
<i>Parapenaeus longirostris</i>	6.56	3.25	5.15	7.09	3.39	5.95
Anomura (un)	4.67	3.08	4.07	4.18	2.81	5.01
Paguridae (un)	5.08	4.37	3.94	2.19	4.21	4.55
Brachyura (un)	3.75	1.08	2.98	4.46	0.98	3.01
Xanthidae(un)	4.89	2.11	4.22	6.05	2.26	5.01
Ostracoda (un)	3.06	4.08	2.97	4.11	3.77	3.44
Hexapoda (un)	3.99	2.34	3.04	3.47	2.25	1.90
<b>Total GASTROPODA</b>	<b>4.25</b>	<b>2.76</b>	<b>3.63</b>	<b>3.44</b>	<b>1.67</b>	<b>2.81</b>
<b>Total BIVALVIA</b>	<b>2.13</b>	<b>4.01</b>	<b>2.67</b>	<b>2.04</b>	<b>3.98</b>	<b>2.83</b>
<b>Total CEPHALOPODA</b>	<b>2.12</b>	<b>3.11</b>	<b>1.95</b>	<b>1.40</b>	<b>1.01</b>	<b>1.28</b>
<i>Sepiola rondeleti</i>	1.11	2.57	1.34	0.00	1.95	1.01
<b>Total ECHINODERMATA</b>	<b>0.98</b>	<b>1.24</b>	<b>1.01</b>	<b>1.18</b>	<b>0.92</b>	<b>0.00</b>
<b>Total TUNICATA</b>	<b>1.01</b>	<b>1.62</b>	<b>0.98</b>	<b>0.98</b>	<b>0.74</b>	<b>0.01</b>
<b>Total PISCES</b>	<b>38.21</b>	<b>17.42</b>	<b>33.26</b>	<b>36.57</b>	<b>15.66</b>	<b>34.16</b>
<i>Gobius sp.</i>	14.08	7.12	12.44	11.03	4.67	10.76
<i>Trachurus trachurus</i>	6.56	3.04	5.77	7.44	3.56	6.67
<i>Sardina pilchardus</i>	5.95	2.01	5.11	2.89	1.23	2.62
<i>Engraulis encrasicolus</i>	3.16	2.23	2.99	5.56	1.36	5.01
<i>Mullus sp.</i>	3.12	0.98	2.76	1.44	0.97	0.99
<i>Atherina sp.</i>	2.45	1.01	2.18	1.56	1.53	2.04
Teleost (un)	2.89	1.03	2.01	6.65	2.34	6.07
<b>Other items</b>	<b>9.49</b>	<b>6.83</b>	<b>11.26</b>	<b>9.55</b>	<b>6.27</b>	<b>11.02</b>
Fish Scales	0.35	0.67	0.36	0.11	0.44	0.23
Eggs	1.13	0.45	1.34	0.90	0.38	1.18
Sediment	6.03	4.18	7.21	6.53	3.23	7.36
Unidentifiable items	1.98	1.53	2.35	2.01	2.22	2.25

Figure 2

### Additional information about the habitat

Most of the species present in the Sea of Marmara are eurythermic, so that they are not much affected by the changes of temperature above 6°C. The primary important limiting factor for their distribution seems to be the salinity, but the vertical distribution of this variable allows even the stenohalin forms to live in the same water column separated by the halocline at different depths where they can find suitable water.

The same rule applies for the stenothermic fish species. The thermal structure below the thermocline serves as shelter for the warm water species all year round with an average temperature of 14.2°C.

In the Sea of Marmara the vertical distribution of salinity and temperature plays a pronounced role on the distribution of fish and bottom (demersal) fauna elements.

Investigations on the distribution of the benthic fauna has shown that most of the stenohalin forms can penetrate into the Sea of Marmara, where water with Sigma-T28 ends. On the other hand, some stenohalin and stenobath Black Sea demersal species cannot penetrate into the Sea of Marmara where they cannot find a suitable water mass with a Sigma-T of 14-15 at a depth 36-45m. where they can live.

One can conclude that the vertical salinity distribution in the Bosphorus area is the most important ecological factor for the distribution of the stenohalin forms, forming a barrier to the species originating from the Mediterranean as well as from the Black Sea.

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