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CONDITION FACTOR OF THREE SPECIES FROM THE BULGARIAN BLACK SEA COAST

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Abstract: ***The condition factors of Trachurus mediterraneus ponticus, Engraulis encrasicolus and Sarda sarda were studied. Mean condition factor for T. mediterraneus ponticus was 0.77±0.28, while it was 0.63±0.17and 2.47±1.43 for E. encrasicolus and S. sarda, respectively. There was a significant difference (p<0.05) in the mean condition factor of male and female T. mediterraneus ponticus, while in S. sarda and E. encrasicolus there was not a significant difference in the condition factors of males and females. It was observed that the autumn season condition factors of T. mediterraneus ponticus and E. encrasicolus were higher than summer season values.***
Key Words: condition factor, horse mackerel, anchovy, Atlantic bonito, Black Sea

I. INTRODUCTION

The mid-water pelagic-trawl commercial target species in the Bulgarian Black Sea study area are small pelagic fishes, mainly anchovy and horse mackerel. The values of the local catches are relatively high, as a consequence of the high demand for these resources for direct consumption (Yankova 2013b).The small pelagic-species production is characterized by high interannual fluctuations that appear to be unrelated to the level of fishing effort. On the contrary, there is strong evidence that yearly production is connected to the success of reproduction, which in turn can be related to the direct or indirect effect of favorable environmental conditions (i.e. the availability of food, as determined by the timing of zooplankton (Yankova *et al.* 2014).The Atlantic bonito, *Sarda sarda* (Bloch, 1793), is one of the most abundant small tuna-like species which exists with a wide ranging distribution spanning tropical and temperate areas of the Atlantic ocean, including the Mediterranean and Black Sea (Yoshida, 1980; Sabatés and Recasens, 2001).

In fisheries science, the condition factor is used in order to compare the "condition", "fatness" or wellbeing of fish and it is based on the hypothesis that heavier fish of a particular length are in a better physiological condition (Bagenal, 1978). Condition factor is also a useful index for the monitoring of feeding intensity, age, and growth rates in fish (Oni *et al*., 1983). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live. Condition factors of horse mackerel was investigated and reported by Yankova (2009a, b), Yankova and Raykov (2009), Yankova (2010), Yankova (2013a). Despite their importance, little is known about the biology and ecology of *S. sarda* and *E. encrasicolus* in the Bulgarian Black Sea waters. For instance, only a few studies have provided some biological information of the anchovy in the Bulgarian Black Sea (Mikhailov 2005). However, the condition factors of both species have not yet been analyzed. These report focused on the determination of changes in condition factor with season, fish length, sex and reproductive status of fish.

II. MATERIAL AND METHODS

Fish samples were collected between April 2012 and December 2012 from the commercial catches landed in Bulgarian Black Sea coast. A total of 3080 fish were collected throughout the study period. Fork length (FL) of each individual fish was measured to the nearest cm by using ameasurement board. The length frequency data were pooled into groups of 0.5 cm length intervals. The sex was assigned macroscopically.Fulton'scondition factor was calculated from the expression (Bagenal, 1978): $K= 100\ W/L^3$. Where W is the whole body weight in grams and L the standard length in millimetres.All results obtained in these analyses of *T. Mediterraneus, E. encrasicolus* and *S. sarda* are carried out for male, female and total samples.

III. RESULTS

The mean condition factors for the *Trachurus mediterraneus ponticus*, *Engraulis encrasicolus* and *Sarda sarda* in the Bulgarian Black Sea coast are shown in Table 1. The results indicated that there was a significant difference between the condition factors of male and female *T. mediterraneus* ($p<0.05$). There were not significant differences between the condition factors of male and female fish in other two species.

Table 1. Condition Factor of *T. mediterraneus ponticus*, *E. encrasicolus* and *S. sarda* in the Bulgarian Black Sea coast.

Species	Summer season	Number	Autumn season	Number	T-test	P
T. mediterraneus ponticus	0.74±0.32	340	0.99±1.12	270		0.05
E. encrasicolus	0.68±0.29	420	0.85±0.92	290		0.05
S. sarda	-	-	2.53±1.49	340		0.05

The condition factors were also checked during summer and autumn seasons (Table 2). The condition factor for *T. mediterraneus ponticus* in autumn season (0.99±1.12) was significantly higher than that (0.74±0.32) in summer season ($p<0.05$).The same trend was observed in *E. encrasicolus* while the autumn condition factor (0.85±0.92) was significantly higher than the mean value of summer season (0.68±0.29) ($p<0.05$).

Table 2. Seasonal variation and t-test analysis of the condition factor of both sexes of *T. mediterraneus ponticus*, *E. encrasicolus* and *S. sarda* in the Bulgarian Black Sea coast.

Species	**Summer season**	**Number**			
T. mediterraneus ponticus	0.74±0.32	340			
E. encrasicolus	0.68±0.29	420	0.83±0.92	290	0.05
S. sarda	-	-	2.53±1.49	340	0.05

Figure 2 shows the variations in condition factors with standard lengths. In *S. sarda* (Fig.2A), three phases are easily distinguished. In phase I, there was a significant increase from 2.94±0.15 (27 cm) to 3.36±0.50 at a length of 29 cm ($p<0.05$). In phase II, there was a decline to 1.73±0.30 at a standard length of 33 mm. In the third phase the condition factor increased from1.73±0.30at a length of 33 cm to 2.14±0.3 at a size of 34 cm.

In T. *mediterraneus ponticus* (Figure 2B), the size increase ranged from 0.84+0.05 (15 cm) to 1.35+0.05 (15.5 mm) ($p<0.01$). Then, it significantly slumped from the previous level (1.35±0.05) to 0.81± 0.41 at a length of 16 cm ($p<0.05$). Condition factor values of *E. encrasicolus* (Figure 2C), registered a significant decrease ($p<0.05$) between the size range of 13 cm and 13,5 cm from 0.53±0.20 to 0.31±0.11, respectively. Thereafter, it significantly increased ($p<0.05$) to a mean value of 0.58±0.22.

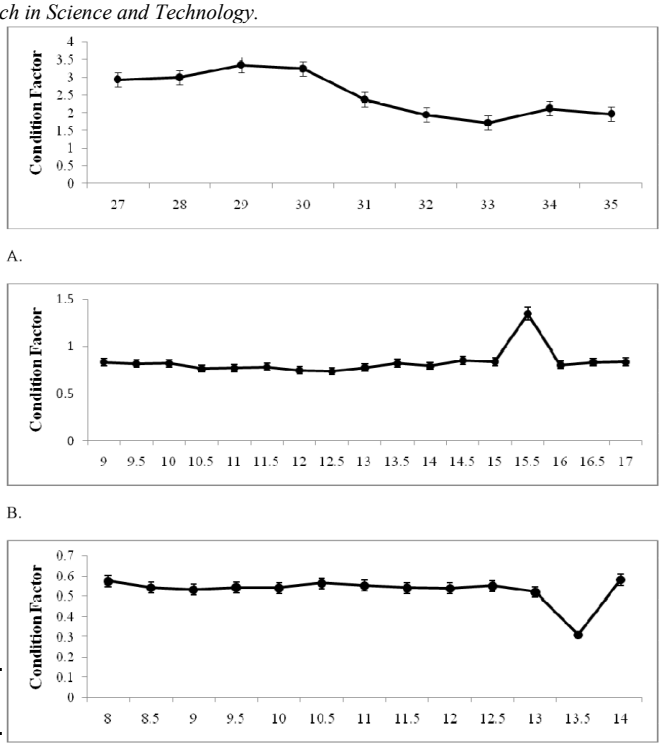

Figure 2. Variation of condition factor with fish size.

IV. DISCUSSION

However, the condition factor values of *T. mediterraneus ponticus* from the current study are relatively higher than those reported for the other study (Yankova, 2009; Yankova and Raykov, 2009; Yankova, 2010). Similarly, the condition factor for *E. encrasicolus* in our study is higher than that found for the same species by Giraldez and Abad, 1995 for western Mediterranean. Similar results have been observed by Aka *et al*., 2004 for the Black Sea. Environmental factors have been taken into consideration in order to account for spatial and temporal differences in condition factor of fish (Bagenal, 1978; Braga, 1986; Ekanem, 2004).

The results of the current study also presented that there were no significant variations in condition factors with respect to sex, on the contrary to *E. encrasicolus*, but the study was in agreement with the values reported for anchovy (Sinovčič, 2000; Millan, 1999; Özdamar, 1991).It was found that autumn season condition factor of *T. mediterraneus ponticus* and *E. encrasicolus* were higher than summer season values. Seasonal variation in the condition factor of fish has been reported for *T. mediterraneus ponticus*. However, the results of this study do not conform to those published for *E. encrasicolus* (Mikhailov, 2005) in which no seasonal changes were observed in condition factor. Despite this difference in observation, Oni *et al*., (1983) noted that condition factor is not constant for a species or population over a time interval and might be influenced by both biotic and abiotic factors such as feeding regime and state of gonadal development (Saliu, 2001). Also, Alegria-Hernandez (1994) reported that changes in the condition of the fish are related to the development and maturation of the gonads when, due to the significant energy expenditure for these processes, the condition of the fish declines.

This study affirmed that there is a variation in condition factor by size (length) classes in three species studied. The

general trend is that in *S. sarda* relatively lower condition factors were recorded for relatively large sizes, while for *T. mediterraneus ponticus* and *E. encrasicolus* relatively higher condition factors were recorded for rather smaller fish.

V. CONCLUSIONS

This study presented the basic information on the condition factors for *T. mediterraneus ponticus*, *E. encrasicolus* and S. *sarda* species from the Bulgarian Black Sea coast, which would be useful for fishery managers as well as the sustainable management of its stocks in the region. Moreover, there are no conditions factors currently in the Fish Base for these species and therefore, our results may contribute to this invaluable database.

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