Exploitation and Mortalities of Bluefish (*Pomatomus saltatrix* L.) in the Sea of Marmara, Turkey

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Abstract

A total of 2813 bluefish from the Sea of Marmara were monthly collected from commercial coastal artisanal fisheries, purse seines, landing at Istanbul fish market between January 2003 and December 2004. The maximal catch length in the study samples was 45.3 cm and mean length was 16.9 cm ± 0.01 (8.4 – 45.3 cm). Total (Z), natural (M) and fishing (F) mortalities of bluefish from Marmara Sea were found as 0.60 $year^{-1}$, 0.36 $year^{-1}$and 0.96 $year^{-1}$, respectively. The higher exploitation rate (E=0.62) and younger individuals from the landings are evidence of heavy fishing pressure on bluefish in the Sea of Marmara.

Key words: Exploitation, mortality, bluefish, *Pomatomus saltatrix*, Marmara Sea.

INTRODUCTION

Bluefish, *Pomatomus saltatrix* (Linnaeus, 1766), is a pelagic, migratory and cosmopolitan species which inhabits warm and temperate waters [1]. They are found throughout the Mediterranean and the Black Sea [2]. Bluefish are most common along surf beaches and rock headlands in clean, although adults can also be found in estuaries, and migrates to warmer water during winter and to cooler water in summer [3]. Similarly, bluefish migrates via the Aegean Sea to northward from the Mediterranean in spring and returns southward in the early autumn in Turkish waters.

Bluefish are mainly caught by artisanal fishery, includes handlines, encircling nets, gillnets, and otter trawls and purse seines in Turkey. Üner [4] notified that the bluefish have been caught by encircling nets, bottom set nets, pond nets, purse-seines and various types of handlines in the Bosphorus since late 1950's.

Total annual bluefish catch in Turkey was 25.000 metric tons in 2002 [5]. The maximal amount in the world was recorded as 60.000 tons in 1983, and declined to about 50.000 tons in 2002 [6]. This figures indicated that the Turkish bluefish fishery reached approximately to the half of the world annual yield. But huge quantities are traditionally obtained from young individuals of the bluefish, and there is a likely heavy fishing pressure on bluefish. So, these paper goals that whether any fishing pressure on bluefish or not by using mortality and exploitation rates in Marmara Region.

MATERIAL AND METHODS

A total of 2813 bluefish from the Sea of Marmara were monthly collected from commercial coastal artisanal fisheries, encircling nets, gillnets, and from purse seines, landings to Istanbul fish market from January 2003 to December 2004. A total of 75 selected fishing vessels, participated to bluefish fishery were investigated in various fishing ports such as Poyrazköy, Rumelifeneri, Marmara Island, Kumbağ, Karabiga, Çanakkale, Gelibolu, Çardak, Bandırma, Tirilye, Hoşköy, Barbaros, Tekirdağ, İzmit, etc. in the Sea of Marmara.

Fork lengths (FL) of fish have been measured to nearest ± 0.1 cm. And the pair of 1114 otoliths was used for ageing. Sagittal otoliths were removed, wiped clean, and stored dry in U-plates, and then otoliths were placed in glycerol and were examined under reflected light using a binocular microscope.

Natural mortality of bluefish was computed from Pauly's [7] following multiple regression formula,

$$\ln M = -0.0152 - 0.279 * \ln L_{\infty} + 0.6543 * \ln K + 0.463 * \ln T.$$

But Pauly [8] proposed that the formula can be calculated lower percent 20 for schooling fishes. The converted formula:

$$M = 0.8 * \exp (-0.0152 - 0.279 * \ln L_{\infty} + 0.6543 * \ln K + 0.463 * \ln T).$$

Where M is natural mortality in a given stock, L_{∞} is asymptotic length, K is growth coefficient and the value of T is the annual mean temperature (in ºC) of the water. Non-seasonal growth parameters, L_{∞} and K, were estimated with von Bertalanffy growth formula in the FISAT (FAO-ICLARM Stock Assessment Tools) computer programme [9]. Mean annual temperature, T, for Marmara Sea was obtained from General Directorate of the Meteorological Service (GDMS).

Total mortality (Z) was estimated from the mean size in the catch, developed by Beverton and Holt [10]. Z can be estimated from mean length in the catch from a given population by means of $Z = K (L_{\infty} - L_{mean}) / (L_{mean} - L_c)$. Where L_{∞} and K are parameters of the von Bertalanffy growth equations, L is the mean length in the catch, and where L_c is the mean length at first capture, and L_c is normally estimated from selection experiments. Erkoyuncu [11] recommended that if L_c is not available, L' can use in the

formula instead of the L_c, *i.e.* $L_c = L'$. Where L' is the minimum length of subsequent length group than the concentrated lengths in the length frequency record.

Fishing mortality (F) can be estimated from F=Z-M. Once values of F and M are available, an exploitation ratio (E) can be computed from E = F / Z. Which allows one to assess if a stock is overfished or not, on the assumption that the optimal value of E (E_{opt}) is about equal to 0.5 [7].

RESULTS

The majority of recreational and sport fishing effort for bluefish is focused in shallow, nearshore waters in autumn. During the migration, especially in the Bosphorus and the Dardanelles, young bluefish schools can be caught by artisanal fishers such as anglers, hand liners, encircling netters (46-64 mm mesh opening), and set netters (64 mm mesh opening). However, main fishing activity for bluefish is purse-seine (24 mm mesh opening) in all of the Marmara Sea. During the survey, a total of 75 vessels were censused. All of artisanal boats, made from wooden material, were varied 5 and 13 m length and have 49.4 hp ± 5.2 engine power, and purse seiners, made from sheet iron material were between 18 and 38 m length and have 1100 hp ± 266.7 engine powers. The purse seiners are especially concentrated to bluefish capture between September and December in Marmara region. So, most of young bluefishes

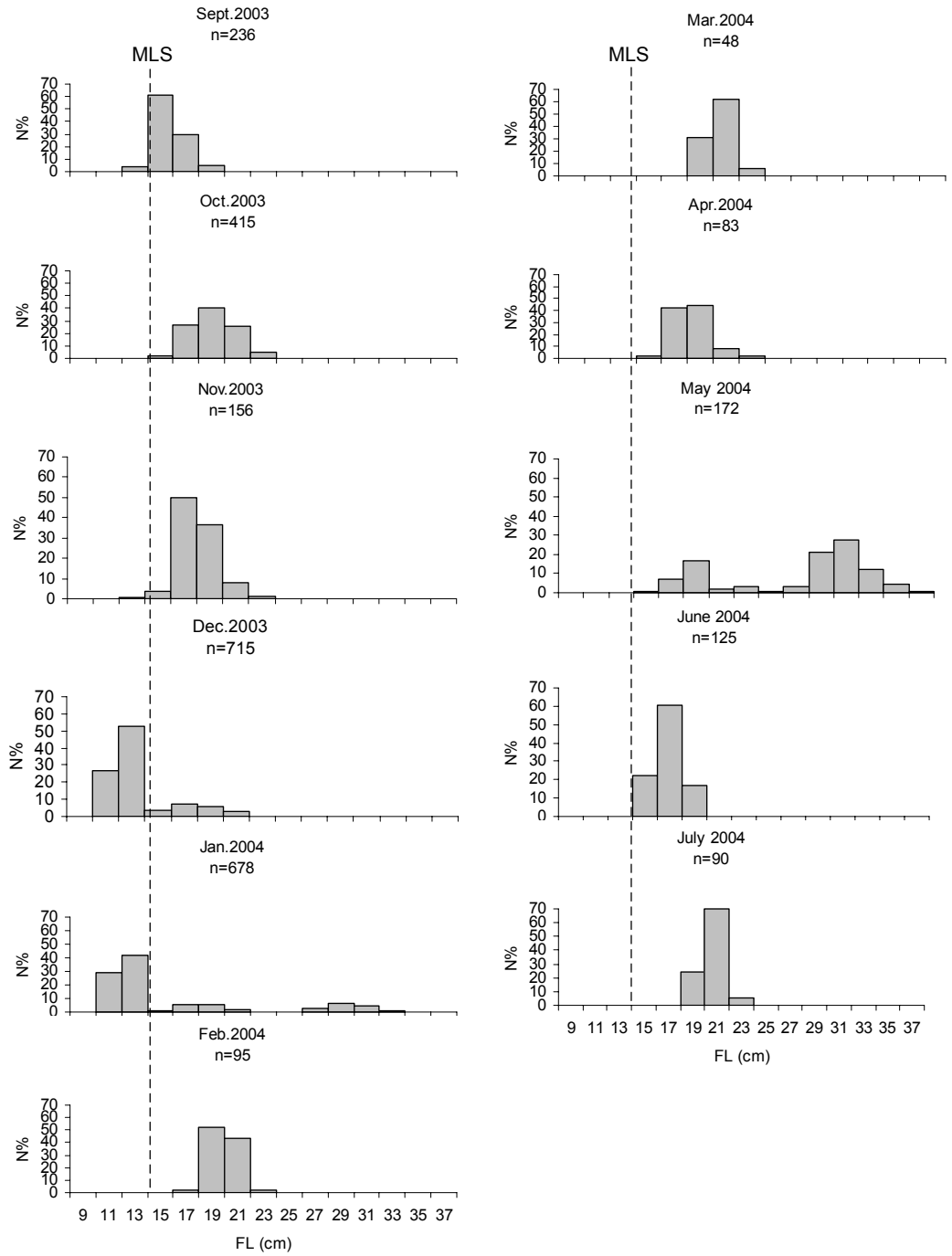

Figure 1. Monthly length frequencies of bluefish in Marmara Sea (MLS: minimum landing size)

are caught easily during the migration. The monthly length frequencies of bluefish are shown in Figure 1. Bluefish were not found in August in anywhere because of spawning migration to the Black Sea.

Mortalities of bluefish from Marmara Sea are demonstrated in Table 1. The mean annual habitat temperature (according to GDMS), L_{mean} and L' are assumed as 16.3ºC, 17.97 cm and 14 cm, respectively. L_{∞} and K were calculated as 51 cm and 0.228 year^{-1} in both sexes, respectively.

Table 1. Mortalities (M, F, Z) and exploitation rate (E) of bluefish in Marmara Sea

Natural Mortality **M** year^{-1}	Fishing Mortality **F** year^{-1}	Total Mortality **Z** year^{-1}	Exploitation Rate **E** year^{-1}
0.36	0.60	0.96	0.62

DISCUSSION

Bluefish were primarily exploited by purse seines in the Marmara Sea. Commercial catches were dominated by fish between 11 and 23 cm fork lengths for the purse-seine fleets and by fish >23 cm for gill netters and/or handlines. The maximal catch length of only one individual in the study was 45.3 cm and mean length was 16.9 cm ± 0.01 (8.4 – 45.3 cm). Türgan [12] reported that the maximum length was 68 cm and mean length was 28.5 cm (5 - 68 cm). It is shown that there was a decrease in mean length of fish caught by purse seines and gill nets from 1959 to 2004. Fishing mortality (F) has been much higher than the natural mortality. In addition, the minimum landing size (MLS) for bluefish, which is 14 cm in Turkish Fishery Regulation Circular (TFRC), may also caused to rise of fishing mortality.

In conclusion, the higher exploitation ratio (E=0.62) and younger individuals from the landings are evidence of heavy fishing pressure on bluefish in the Sea of Marmara. So, the authors propose that fishing effort of the fleets have to determine and selectivity studies of the gears must made, and MLS of bluefish has to re-assessment for sustainable bluefish fishery.

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