

STATE OF HORSE MACKEREL (*TRACHURUS MEDITERRANEUS PONTICUS* ALEEV, 1956) INHABITED BULGARIAN BLACK SEA WATERS IN 2004 - 2010

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СЪСТОЯНИЕ НА САФРИДА (*TRACHURUS MEDITERRANEUS PONTICUS* ALEEV, 1956) ПРЕД БЪЛГАРСКИЯ БРЯГ НА ЧЕРНО МОРЕ ПРЕЗ ПЕРИОДА 2004 – 2010 Г.

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Резюме: В настоящата статия са проследени в сравнителен аспект измененията протичащи във възрастовата структура, линейното и тегловно нарастване, физиологичния статус (кондиционен фактор, *c.f*) и динамиката на половата структура на черноморския сафрид (*Trachurus mediterraneus ponticus*) за периода 2004 - 2010 година. През отчетния период най-общо се задържаха позитивните промени в състоянието на сафрида, но в отделни години се отчетоха и отклонения в някои от характерните за вида биологични параметри. Възрастовата структура се характеризира с 7 възрастови класа. По-значителен дял имат тригодишните риби (възраст 3) през 2004 г. - 35.00% и до известна степен 2005г. – 28.5% и 2007 г. – 26.1%. Двегодишните са представени високо през целия период с процентно участие вариращо между 15.8% и 28.4%. Коефициента на охраненост отбеляза покачване. През периода 2004-2008 година особено характерно покачване се наблюдава при 3-3+ и 4-4+годишните. Флукуациите в размерно-тегловната структура на черноморския сафрид от уловите пред българския бряг на Черно море са твърде променливи и са в резултат на особеностите при групиране на стадата по време на миграцията и размножаването, риболовната преса и факторите на средата.

Ключови думи: морска биология, ихтиология, сафрид *T.m.ponticus*, популационна динамика, черноморско крайбрежие

INTRODUCTION

Black Sea fisheries largely based on cross-border migratory species (Kolarov 2005). Horse mackerel, *Trachurus mediterraneus ponticus* Aleev, 1957, is a major commercial fishery for the waters of the Black Sea and belongs to the family Carangidae. *T. m. ponticus*, plays a crucial role in the food web of pelagic fish in the Black Sea as prey for many predators as bonito, bluefish, dolphins and etc. The species is also a major consumer of zooplankton, especially when stocks are large, thus acting as a competitor to other fish feeding on plankton [1].

For the Bulgarian sector of the Black Sea horse mackerel had crucial part, but catches in the 90s decreased substantially [2]. The reasons for this are related to changes in the Black Sea ecosystem under the influence of multiple anthropogenic factors [1,3,4]. Overfishing, eutrophication and the increasing presence of the ctenophore *Mnemiopsis leydii* affect the number of species, leading to trophic cascades and destruction of eggs and larvae [1,4]. Given that the conservation of living marine resources and fisheries management are faced with growing problems in the Black Sea, the continuous updating of scientific information on the status of marine fisheries resources is essential [5]. Environmental fluctuations are thought to strongly influence the abundance of pelagic species and may also result in life cycle and growth pattern changes, therefore, data gathered from long-term studies are critical for determining average growth parameters [6].

The goal of present study was to investigate the state of one of the commercial species of Black Sea fish, horse mackerel (*Trachurus mediterraneus ponticus*) from 2004 to 2010.

MATERIAL AND METHODS

The samples of *Trachurus mediterraneus ponticus* belonging to Carangidae families were caught in Bulgarian Black Sea area (Figure 1) from 2004 to 2010.

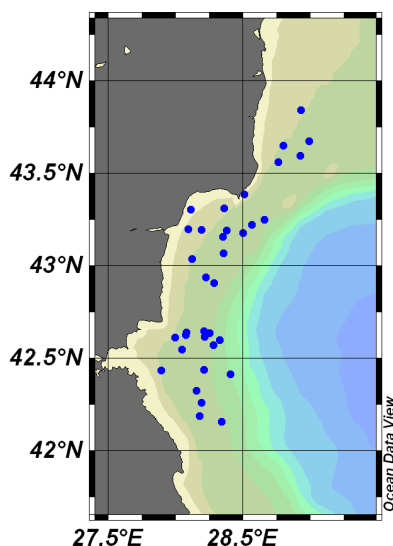


Figure 1. Scheme of area investigated.

Fish samples were caught by mid-water trawl with 6.5 mm codend mesh. The captured fish were transported immediately on ice to the laboratory for analysis. Total length (TL) was measured to the nearest 0.1 cm and body weight to the nearest 0.1 g. used otoliths to determine age, which was determined from otolith rings, as previously described by Pravdin (1966). Otoliths removed from the fish were stored dry in paper envelopes, and were then examined in glycerin under a digital microscope (Microbiotest, Ltd.). Two independent observations of each sample were performed with reflected lights and unreadable otoliths were eliminated from age determination.

The biological analyze of 1,794 fish – 932 female and 862 male was made. The total (TL) lengths, weight of fish and sex were recorded. Condition factor (CF) was calculated using value of soma weight from the equations:

$$CF \% = (W * 100) / (TL^3) \quad (\text{Anisimova and Lavrovsky 1983})$$

where W – weight in grams of fish, TL – total length;

RESULTS

The analyze of distribution of the different age groups specimens showed that in 2004-2010 three age groups (1-1+, 2-2+, and 3-3+) were prevalent in catches (Figure 2).

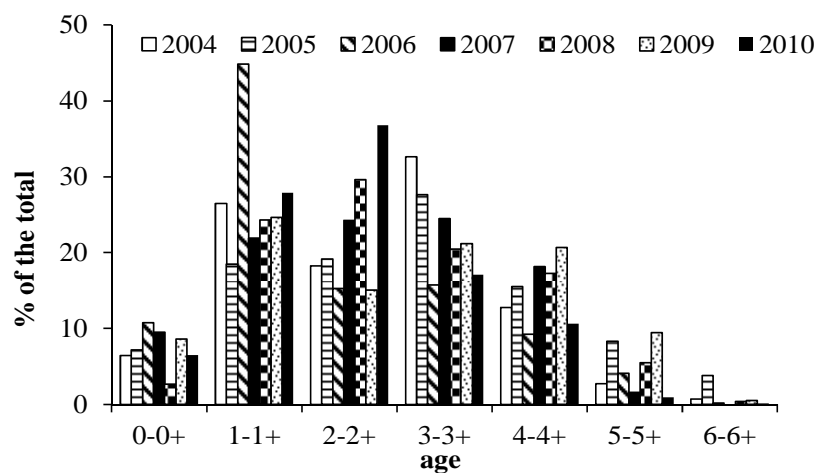


Figure 2. Age composition of horse mackerel *Trachurus mediterraneus ponticus* inhabited Bulgarian Black Sea region in 2004–2010.

At study of sex ratio it was found that in all investigated periods the main percentage of earliest years fish was presented by females, but old fish consisted mainly by males (Figure 3).



Figure 3. Sex relation of horse mackerel *Trachurus mediterraneus ponticus* inhabited Bulgarian Black Sea region in 2004–2010.

It is seen that higher values of length of female and male of almost all of fish were in 2004-2010 (Figure 4).

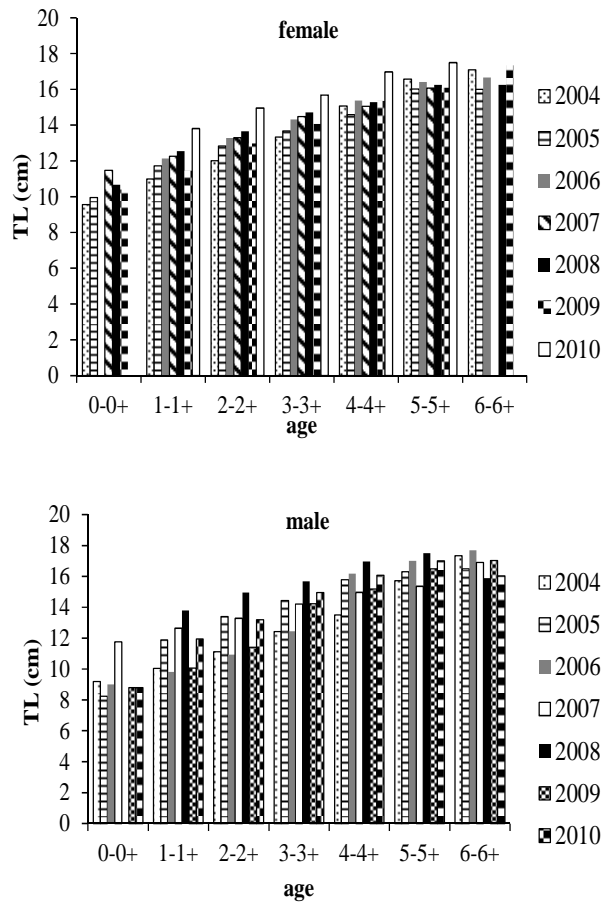
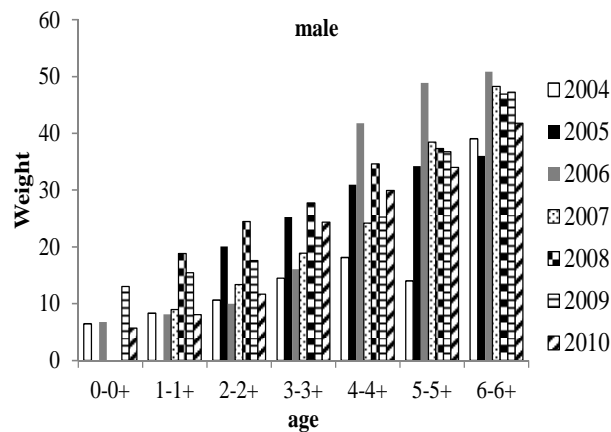


Figure 4. Size (TL,cm) of horse mackerel *Trachurus mediterraneus ponticus* inhabited in coastal area of Bulgarian Black Sea region in 2004–2010.

Same data were obtained for weight. However, fish bodies smaller growth was observed from 2004–2010 for female and male of age from 3+ to 6+, with some changes in inner years. For fish of age groups 2+ and 3+ the increasing of weight from 2004 to 2010 was noticed and such changes were higher for male (Figure 5).



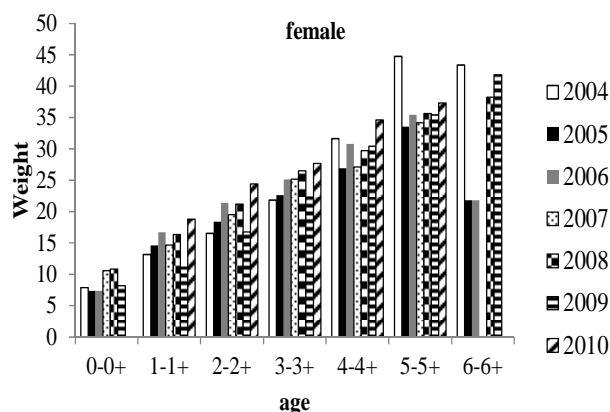


Figure 5. Weight (g) of horse mackerel *Trachurus mediterraneus ponticus* inhabited in coastal area of Bulgarian Black Sea region in 2004–2010.

The condition factor of male and female of horse mackerel of age of 3+–4+ years was gradually increasing from 2004 to 2008 (Figure 6).

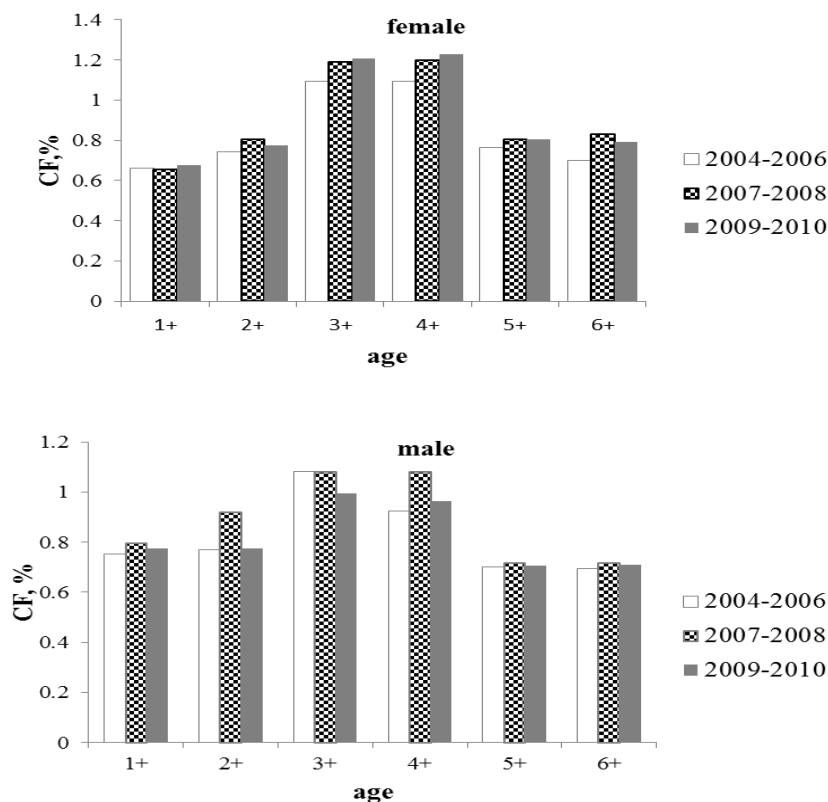


Figure 6. Condition factor (%) of horse mackerel *Trachurus mediterraneus ponticus* inhabited in coastal area of Bulgarian Black Sea region in 2004–2010.

DISCUSSION

As it has been described above, during period of investigations we caught fish of 0-6 age groups (Figure 2). The fish in average age group (1+ – 3+ years) dominated. Similar results of study were obtained for horse mackerel in previous (2007–2008): in Bulgarian Black Sea area the main percentage of fish was presented by fish of 2+ – 4+ years of age [7], but in southwest coastal area of Turkey – age of 2+–3+ years [8]. The fact that, older specimens were presented by males can confirm high female vulnerability under bad conditions of environment.

It is known that maximal level of anthropogenic impact on Black Sea was in 1990s in XX century [9, 10, 11]. Nowadays, in spite of ecosystem renovation, the negative effects of chronic contamination on Black Sea fish are continued [10, 12, 13, 14, 15, 16, 17,18,19]. Such situation confirms our data obtained about yearly dynamic of biological state changes of *Tr. m. ponticus*. The fact that, fish bodies smaller growth and possible reasons of this were obtained by different scientists. So, authors have explained the reason of body size in horse mackerel from 2001 to 2007 by overfishing [1, 4, 20, 21, 22, 23, 24, 25]. It is known that, low zooplankton density has effected size decreasing of pelagic fishes [1, 11, 25, 26, 27, 28, 29, 30, 31, 32, 33]. In the period of our analyses the concentration of *Mnemiopsis leidyi* was not critical [11], that is why fish bodies' smaller growth was not connected with quantity of zooplankton for early development stages of fish. Adult horse mackerel fish is predator, it feeds with small fishes and crustaceans [35]. Consequently, smaller bodies growth of adult specimens is result of mainly industrial and domestic pollution of Bulgarian Black Sea area. The size decreasing of males and females of horse mackerel fish can be connected not only with direct and indirect pollution influence, but, in our opinion, with changes of water temperature, which were noticed in coastal area of Bulgarian Black Sea in investigated period, also (Table 1). The data presented by Bulgarian hydro meteorological observatory show that middle year values of sea temperature during 2004-2010 are gradually increasing.

Table 1. Middle year temperature of sea in Bulgarian Black Sea water.

	2004	2005	2006	2007	2008	2009	2010
Sea temperature, °C	19.0	19.5	18.17	19.5	19.42	18.83	20.17

The difference between min and max values of middle year temperature in 2006 and 2010 was for water -2°C (table 1). Condition factor was increasing with the increasing of time. It is, probably, show the better food base in last years that is proved by positive dynamics of fish weight increasing at 1+–2+ and 2+–3+ years of age. The effect of biomass and level of accumulative lipids increase for pelagic Black Sea fish next 90 years was noticed by Dobrovolov and Ivanova (2007) and explained as a good food provision.

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