

NORTHWARDS RANGE EXPANSION OF *Sparisoma cretense* (Linnaeus, 1758) IN THE TURKISH AEGEAN SEA

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Abstract:

The northward establishment of *Sparisoma cretense* in the Turkish waters of Aegean Sea is documented. Three samples of this thermophilic species were collected on 19 March 2014 along the eastern coasts, at the limits between the Central and Northern part of the basin. Meridionalization and tropicalization in the Aegean Sea are briefly discussed.

Keywords: *Sparisoma cretense*, Meridionalization, Tropicalization, Global warming, Thermophilic species, Aegean Sea

Introduction

Recent marine communities are being altered and remodelled depending on natural changes which occurred over geological times. However, the man-made effects associated with advancement of civilization are destructive rather than formative in marine ecosystems. Main and collateral effects of anthropogenic factors cause the reshuffling of geographical distribution of plant and animal species (Galil, 2007). Considering the Mediterranean Sea, nowadays, the increasing of sea water temperature, caused by the global warming, produces and/or enhances the shift and poleward migration of many taxa that are now extending their natural biogeographical range. Thus some species, typically known as thermophilic are currently colonizing the northern sectors. Following literature Azzurro (2008, 2010, and references within), thermophilic fishes of the Mediterranean can be categorized into two major groups:

1) Native or indigenous fishes, with tropical or subtropical affinity and origin, entered in the Mediterranean during previous interglacial phases of the Quaternary. These species occur typically in the southern Mediterranean, where water temperature is warmer than average. The northward spread of the native warm water biota has been termed as “meridionalization”.

2) Exotic (or non-indigenous fishes), have recently entered the Mediterranean, mainly from the Red Sea or from the Atlantic Ocean. These species have taken advantage of suitable pathways for dispersal in the western and eastern sectors of the Mediterranean, respectively. The increase of water temperature allows the successful introduction and spreading of tropical exotic species in the Mediterranean Sea, a phenomenon that has been called ‘tropicalization’. Another definition that has been used is “demediterraneization” (Quignard and Tomasini, 2000) and represented the process of biotic homogenization of the Mediterranean Sea.

Bianchi (2007) suggested that the phenomenon of the tropicalization of the Mediterranean results from the combination of four factors: Atlantic in-

flux, lessepsian migration, introductions by humans, and present-day sea warming. The same author tends to include in this phenomenon also, the northwards range extension of native thermophilic species, observed in the recent decades. On this basis, it can be suggested therefore that the native thermophilic species appearing northern than the known range could serve as sentinels by providing the first indication of changes in sea-water temperature (Azzurro, 2008).

Parrotfishes consist of 10 genera and 88 species, two in the Mediterranean, the native *Sparisoma cretense* (Linnaeus, 1758) and the Lessepsian migrant *Scarus ghobban* Forsskal, 1775 (Nelson, 2006; Golani et al., 2006). The parrotfish *Sparisoma cretense* is thermophilic species, mainly distributed along the eastern and southern coasts of Mediterranean Sea to the west coast of Europe and Africa from Portugal to Senegal, in depth ranging from shallow waters to 50 m approximately (Bauchot, 1987; Petrakis and Papaconstantinou, 1990).

In this work, the presence of the Mediterranean parrotfish is documented for the first time in the northeastern coasts of the central Aegean Sea, ascertaining the tendency of its population to spread northwards in the basin.

Materials and Methods

On March 19th 2014, a single adult male and two female’s specimens of *S. cretense* (Figure 1.) were collected by a trammel net (mesh size: 20 mm, 1.5 m deep and 300 m long) at a depth of 22 m (on rocky bottom) in Sığacık Bay (N Aegean Sea / 38° 13’ N - 26° 40’ E) (Figure 2). The specimens were fixed in 70% ethanol, deposited in the Faculty of Fisheries Museum Collection, Muğla Sıtkı Koçman University and cataloged under the number MUSUM/PIS/2014-1. Metric characters of the specimens were measured with a digital calliper (to the nearest 0.01 mm), whereas the meristic characters were counted under a stereo zoom microscope having × 20 magnification.



Figure 1. Map of central Aegean Sea indicating sampling area (with asterisk).



Figure 2. Photograph of three specimens, *Sparisoma cretense*, caught in the Aegean Sea

Results and Discussion

The specimens were identified based on criteria presented in Bauchot (1987) and sexual discrimination was performed according to their colour morph (de Girolamo et al., 1999) and confirmed by visual examination of the gonads. Selected main morphometric features of specimens are presented in Table 1.

Warming of the sea is admitted as a major factor that influences the remodelling of the Mediterranean marine biodiversity (Bianchi, 1997; Bianchi and Morri, 2004; Lejeune et al., 2010). Although the occurrence of the native parrotfish *S. cretense* is chiefly documented from the warm-water sectors of the Mediterranean, in the last two decades an advancement of its distribution towards northern and colder sectors of the basin has been reported (Adriatic: Guidetti and Boero, 2001, 2002; Dulčić and Pallaro, 2001; Bello et al., 2004; Azzurro et al., 2011; Kruschel et al., 2012, Ionian Sea: Perdikaris et al., 2012). It could be seen therefore as an indicator species of global warming by scientists. A similar trend is observed in the Aegean Sea. In the Hellenic Aegean waters, the occurrence of the parrotfish, well known from the south, southeastern and central part of the basin, has been recently reported also from the North (Lesvos, Limnos Islands) (Papaconstantinou, 2014). Along the Aegean Turkish coasts,

the species is present in the Southeastern coasts (Akın et al., 2005; Öğretmen et al., 2005; Oz et al., 2007), and also up to the North (Eryilmaz, 2003). Studies based on data including last three decades showed that seawater temperature increased approximately 1–2°C (Pancucci-Papadopoulou et al., 2012; Bianchi et al., 2014) and warming trend is 0.06°C/year in the south Aegean Sea (Lasram et al., 2010; Skliris et al., 2011, Shaltout and Omstedt, 2014). As it is well known, the SST gradient of whole Aegean sub-basin is significantly controlled by water exchange between cold/fresh Black Sea water entering through the Dardanelles Strait and warm/saline Levantine basin water entering through the Cretan Arc Straits (Zervakis et al., 2000; Poulain et al., 2012). Besides, the Aegean SST varies zonary and seasonally, even at the same latitude, due to the Etesian winds and water currents (Kotroni et al., 2001). However, recent studies have demonstrated that sea warming trend of the Black Sea has been increasing significantly. Moreover, future scenarios showed that ever-increasing warming trend in Black Sea leads to decrease in heat changes between Black Sea and Aegean Sea (Kotroni et al., 2001; Shaltout and Omstedt, 2014). Therefore, it has been triggered tropicalization and meridionalization phenomenon underlie changes in the Aegean marine fauna.

Table 1. The main morphometric and meristic characters of *Sparisoma cretense* in the Aegean Sea

Specimens	♀ ₁	♀ ₂	♂
Morphometric characters (mm)			
Total length	222.0	235.0	255.0
Standart length	201.0	210.0	226.0
Body weight (g)	190.34	221.79	267.96
Head length	55.33	58.04	69.60
Eye diameter	10.96	11.02	13.04
Interorbital distance	16.44	16.68	17.07
Preorbital distance	18.49	22.58	29.52
Predorsal length	55.26	58.63	71.43
Preanal length	113.49	115.24	136.48
Body depth	60.15	61.65	73.89
Meristic characters			
Dorsal fin rays	VIII - 10	VIII - 10	XI - 10
Anal fin rays	III - 9	III - 9	III - 9
Pectoral fin rays	12	12	12
Pelvic fin rays	I - 5	I - 5	I - 5
Lateral line	22	21	21

Consequently, on one hand the Aegean is testing the tropicalization phenomenon, being evidently subjected to alien invasions mainly in its south sub-basin, and, on the other hand, it is facing the meridionalization phenomenon, showed by the poleward migration of thermophilic native species, including the parrotfish. Nevertheless, the relationship between tropicalization, meridionalization, and biodiversity is not straightforward due to water warming, moving and/or removed geographical barriers, spatial overlap between alien and indigenous species (Coll et al., 2010).

Conclusion

The presence of *S. cretense* at Sığacık Bay fills first of all a gap of knowledge on its occurrence in the area between the south and north eastern coasts of the Turkish waters of the Aegean Sea, ascertaining the enlargement of its distribution towards the north. Thus, monitoring the occurrence of thermophilic indicator species, such as the parrotfish, will help to predict possible changes on the Mediterranean marine ecosystems.

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