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The Northernmost Confirmation of the Occurrence of Parrotfish (*Sparisoma cretense* Linnaeus, 1758) in the Eastern Mediterranean With Its First Record From Saros Bay (Northern Aegean Sea, Turkey)

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ABSTRACT

An ongoing warming trend is obviously proof in both the surface and deep waters of the Mediterranean Sea. The increasing seawater temperature renders this sea more receptive to invasion by thermophilic species and affects marine species and ecosystems. In this connection, a single specimen of *Sparisoma cretense* was caught on 20 September 2013 off the İbrice Bight at approximately 40°36'07.8"N 26°32'44.3"E (Saros Bay, Northern Aegean Sea, Turkey). This paper presents the first record of *S. cretense* in the Saros Bay (Northern Aegean Sea, Turkey), which is the northernmost confirmed occurrence of the parrotfish for the Eastern Mediterranean.

INTRODUCTION

According to ongoing phylogenetic and evolutionary analyses of parrotfishes, they are asserted to be the subfamily Scarinae belongs to the family Labridae (Westneat and Alfaro, 2005). Nevertheless, some authorities prefer to classify them as a family-level taxon (Randal, 2007). Recently, parrotfishes have been considered to be included in the Scaridae family, which divided into two subfamilies (Van

Der Laan et al., 2014). The subfamily Scarinae includes the genera *Bolbometopon*, *Cetoscarus*, *Chlorurus*, *Hipposcarus* and *Scarus*, whereas the subfamily Sparisomatinae includes the genera *Calotomus*, *Cryptotomus*, *Leptoscarus*, *Nicholsina* and *Sparisoma* (WoRMS, 2020). The Scaridae family consist of 10 genera (Golani et al., 2006) and 99 species, two in the Mediterranean, the native *Sparisoma cretense* (Linnaeus, 1758) and the Lessepsian migrant *Scarus ghobban* (Forsskål, 1775) (Fishbase, 2020; WoRMS, 2020). The parrotfish (*Sparisoma cretense* Linnaeus, 1758) is thermophilic and a necto-benthic species inhabiting rocky bottoms and seagrass beds. It is a daytime feeder, scraping algae, seagrass and small invertebrates from the substrate with its fused, beak-like jaw (Guidetti and Boero, 2001). This species is mainly distributed along the southern and eastern coast of the Mediterranean Basin (i.e., northern Africa, Sicily and the Aegean Sea), in depth ranging from shallow waters to 50 m. approximately (Petrakis and Papaconstantinou, 1990; Vacci et al., 1999). *S. cretense* displays sexual dichromatism (De Girolamo et al., 1999) and a dual mating system, with either multi-male groups or one dominant male holding harems (Alfonso et al., 2002). Petrakis and Papaconstantinou (1990) declared that females mature in the first year while males in the third year and the male to female ratio was almost 1:1. Its spawning period occurs between July-September (De Girolamo et al., 1999) with juveniles recruiting in late summer (Guidetti and Boero, 2001). The species has low economic importance (Kampouris and Batjakas, 2018).

Dulc̆ić et al. (2006) emphasized that the most remarkable change in population structure was observed recently with three species: grey triggerfish (*Balistes capriscus* Gmelin, 1798), ornate wrasse (*Thalassoma pavo* Linnaeus, 1758) and parrotfish (*Sparisoma cretense* Linnaeus, 1758). In this connection, Filiz and Sevingel (2015) underlined that due to being a target species in various fisheries, habitat loss and pollution, the parrotfish population had been evaluated as Endangered (EN) in Turkey (Fricke et al., 2007), Least Concern (LC) in the Mediterranean (Abdul Malak et al., 2011) and proposed for Annexes II and V for the EU Habitats Directive (Fricke et al., 2007). Therefore, any generated biological data concerning this species will be of great value and importance. This paper presents the first record of *S. cretense* in the Saros Bay (Northern Aegean Sea, Turkey), which is the northernmost confirmed occurrence of the parrotfish for the Eastern Mediterranean.

MATERIAL AND METHODS

Saros Bay, which is situated in the Northeastern Aegean Sea, is connected to the North Aegean with a depth of approximately 600 m to the west. The shelf extends at a water depth of 90-120 m. The length of the bay is about 61 km, and the width at the opening to the Aegean Sea is about 36 km (Eronat and Sayın, 2014). As Saros Bay had been closed to bottom trawl fishing since 2000 (Cengiz et al.,

2014; 2015) and no industrial activity was prevalent in the area (Sarı and Çağatay, 2001), the bay can be considered as a pristine environment (Cengiz et al., 2013). A single specimen of *Sparisoma cretense* was caught using the fishing line by a commercial fisherman at a depth of less than 30 m. on 20 September 2013 off the İbrice Bight (Saros Bay, Northern Aegean Sea, Turkey) at approximately 40°36'07.8"N 26°32'44.3"E (Figure 1).

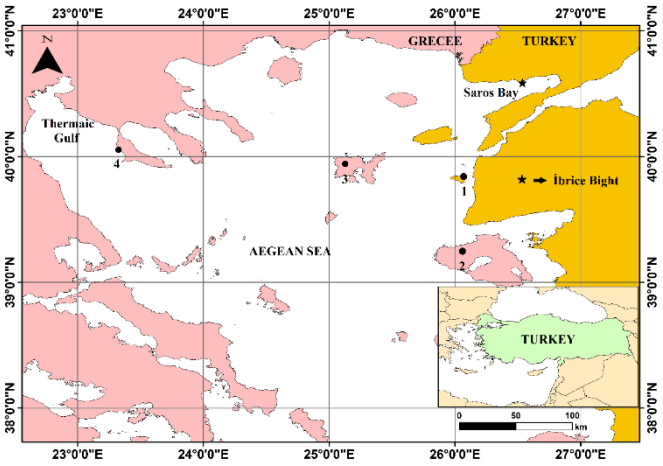

Figure 1. Range extension of *Sparisoma cretense* in Northern Aegean Sea (black dots and star indicate consecutive reports and the most recent record, respectively): 1: Eryılmaz (2003) from Bozcaada Isl., 2: Gerovasileiou et al. (2007) from Lesvos Isl., 3: Kavadas et al. (2012) from Limnos Isl., 4: Kampouris and Batjakas (2018) from Thermaic Gulf (40° 04' 10.7" N and 23° 19' 59.3" E)

The specimen was identified based on Mater et al. (2009), photographed, some measurement and meristic characters were measured. And then, the specimen was fixed and preserved in 6% formalin solution (Figure 2).

Figure 2 - *Sparisoma cretense* captured in the İbrice Bight (Saros Bay, Northern Aegean Sea, Turkey)

RESULTS

The taxonomic position of the species is as following:

Subphylum: Vertabrata

Class: Actinopterygii

Order: Perciformes

Suborder: Labroidei

Family: Scaridae

Subfamily: Sparisomatinae

Genus: *Sparisoma*

Scientific Name: *Sparisoma cretense* (Linnaeus, 1758)

Common Name: Parrotfish

Synonyms: *Euscarus cretensis* (Linnaeus, 1758), *Labrus cretensis* (Linnaeus, 1758), *Scarus canariensis* (Valenciennes, 1838), *Scarus cretensis* (Linnaeus, 1758), *Scarus mutabilis* (Lowe, 1838), *Scarus rubiginosus* (Valenciennes,

1840), *Scarus siculus* (Cocco, 1846), *Sparidosoma cretense* (Linnaeus, 1758)

Some morphometric and meristic characters for *Sparisoma cretense* were given in Table 1. Other morphological characters are as follows: Rather deep body, small eyes, large scales on body and major part of the head, conical snout is shorter than post-orbital length. Lateral line complete, ending at the base of the caudal fin. Dorsal and lateral sides greyish, light on the abdomen.

Table 1. Some morphometric and meristic characters for *Sparisoma cretense* captured in the İbrice Bight (Saros Bay, Northern Aegean Sea, Turkey)

Morphometric characters	**Values**
Total length (mm)	254.0
Standard length (mm)	223.0
Weight (g)	220.0
Anal length (mm)	124.0
Eye diameter (mm)	12.8
Body depth (mm)	76.0
Head length (mm)	57.7
Dorsal fin length (mm)	119.7
Pectoral fin length (mm)	46.5
Meristic characters	
Dorsal fin rays	IX - 10
Anal fin rays	III - 9
Pectoral fin rays	12
Pelvic fin rays	I - 5
Lateral line	21

DISCUSSION

With regard to the Greek waters, this species has been caught in the Dodecanese Island (southern Aegean Sea) by Petrakis and Papaconstantinou (1990), in the Kyklades Island (southern Aegean Sea) by Stergiou et al. (2002) and in the Kriti Island (southern Aegean Sea) by Katsanevakis and Thessalou-Legaki (2009). In addition, Papaconstantinou (2014) documented this species was reported only in the Limnos and Lesvos Islands (northern Aegean Sea) by Kavadas et al. (2012) and by Gerovasileiou et al. (2007), respectively. However, Kampouris and Batjakas (2018) determined its presence at approximately 40°04'10.7" N and 23°19'59.3" E in the Thermaic Gulf (Northwestern Aegean Sea) (Figure 1).

As for Turkey Seas, the parrotfish has been reported by Eryılmaz (2003) in the Bozcaada Island (northern Aegean Sea), by Öğretmen et al. (2005) in the Gökova Bay (southern Aegean Sea), by Filiz and Sevingel (2015) in Izmir Bay (central Aegean Sea) and by Yapıcı et al. (2016) in the Sığacık Bay (central Aegean Sea), as a summary. This species was included in the checklists of Turkish fishes (Fricke et al., 2007). Although several studies on fish communities have been done in the Saros Bay (Koç et al., 2004; İşmen et al., 2007; Altuğ et al., 2011; Cengiz et al., 2011; Keskin et al., 2011a; 2011b), *S. cretense* has never been caught or mentioned for this area. In addition, local fishermen had never caught the parrotfish or shown knowledge of this species.

Four categories of biological response to climatic change can be aligned as follows: (1) the appearance of indicator species, (2) the appearance of new populations, (3) the increase or decrease in fish stocks, based on year-class strength, and (4) structural changes in the ecosystem (Cushing and Dickson, 1977). From this perspective, the unusual occurrences of marine life have been used as indicators of changes in the marine environment (Mearns, 1988) and changes in fish assemblages may be the first indication of an environmental shift (Stephens et al., 1988). In this sense, the faunal changes observed are related to climate change and water warming (Dulčić et al., 1999; Dulčić and Grbec, 2000). They control the rate of change in the geographical distribution of marine species or populations in the sea (Papaconstantinou, 2014) and these changes may affect the status of the Turkish marine fauna and give rise to a rare occurrence in Saros Bay (Cengiz et al., 2019a; 2019b). The northward distributions of the parrotfish inhabiting the warm-water sectors of the Mediterranean Basin have been interpreted by many authors as a signal of climate changes (i.e. water warming) (Vacci et al., 1999; Dulčić and Pallaoro, 2001; Abecasis et al., 2008; Azzurro et al., 2011; Kruschel et al., 2012; Perdikaris et al., 2012; Kampouris and Batjakas, 2018; Ventura et al., 2019). Therefore, the native thermophilic species appearing northern than the known range could serve as sentinels by providing the first indication of changes in seawater temperature (Azzurro, 2008).

CONCLUSION

As a result, the rising of the seawater temperature can be an explanation for the appearance of the species on the Saros Bay. Thus, the known range of *S. cretense* extends from Kriti Island to the Saros Bay in the Aegean Sea. This occurrence could be the base for future monitoring of possible spreading of the species and the record of native thermophilic species, such as parrotfish, may assist in estimating the changes on the Mediterranean marine ecosystem.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' Contributions

Both authors contributed equally to this paper.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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