

## Rapid Communication

# Settlement evidence of the Mediterranean parrotfish *Sparisoma cretense* (Teleostei: Scaridae) in the Central Tyrrhenian Sea (Giglio Island, Italy)

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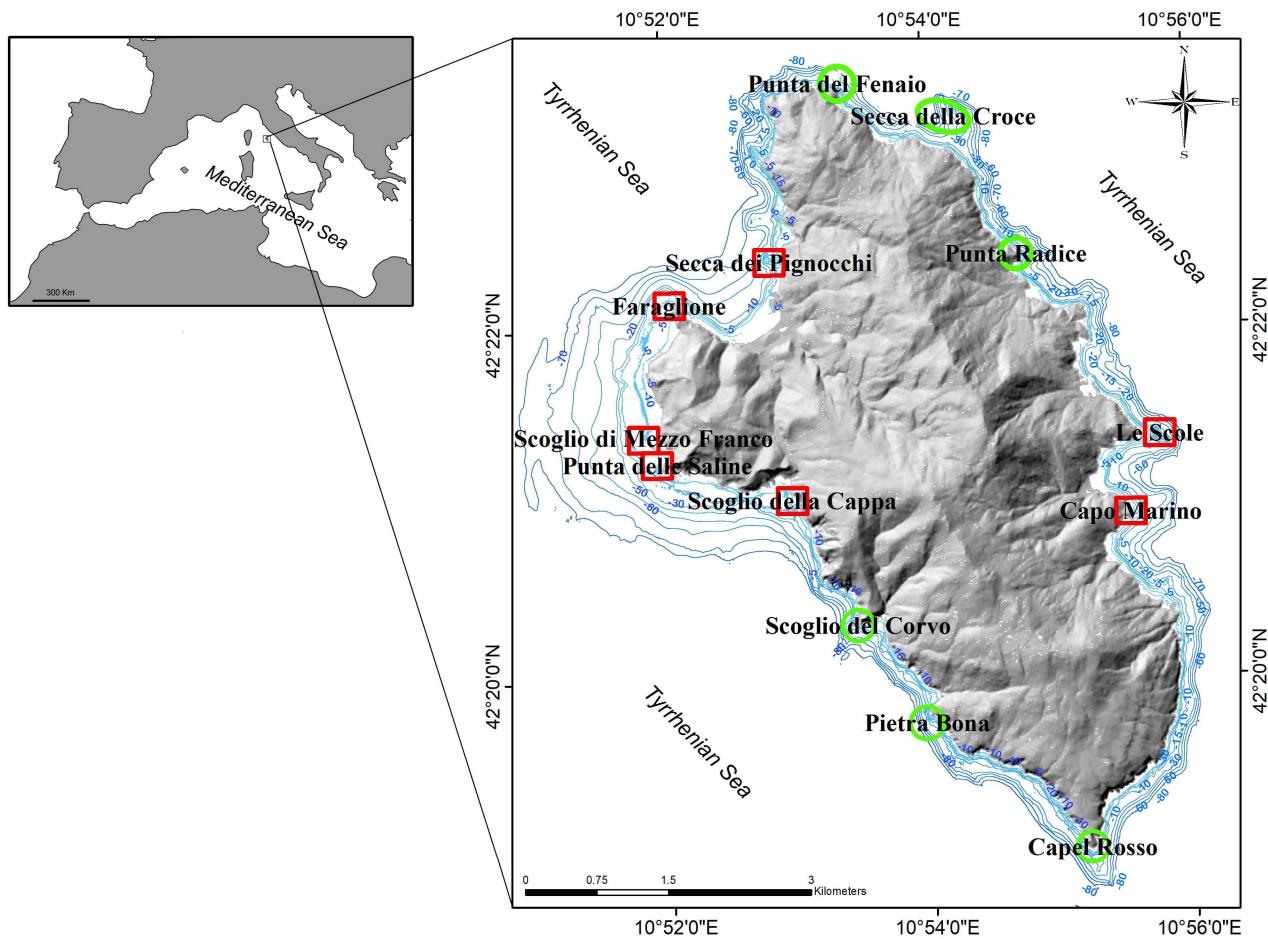
### Abstract

New data are reported on the Mediterranean parrotfish *Sparisoma cretense* in the coastal waters of Giglio Islands (North Tyrrhenian Sea). Using visual census strip transects, we documented the occurrence of both adult and sub-adult individuals, providing evidence on the existence of an established population of this species, 26 years after its first record in the same location. The potential of this warm adapted fish to further expand its distribution across the Mediterranean coasts is raised and discussed.

**Key words:** northward expanding fish, poleward shifts, thermophilic fish, global warming

### Introduction

The Mediterranean parrotfish *Sparisoma cretense* (Linnaeus, 1758) is a coastal species mainly inhabiting rocky bottoms and seagrass beds in shallow waters to about 50 m. It is a daytime feeder, scraping algae and small invertebrates with its fused, beak-like jaw (Guidetti and Boero 2002). In the Mediterranean Sea, its breeding season occurs from July to September with juveniles recruiting in late Summer (Guidetti and Boero 2002). Being distributed in subtropical climates (eastern Atlantic – from Senegal to Portugal; Macaronesian archipelagos – Azores, Madeira, Canaries and Cape Verde islands; southern Mediterranean coasts Sea – North Africa, Sicily Strait, South and East Sicily, South Aegean Sea), this species has been traditionally considered as one of the so-called Mediterranean thermophilic fish (Guidetti and Boero 2002; Azzurro 2008). In Italy, this species is known to be very common in the southernmost localities (Azzurro et al. 2013), whilst an increasing number of sporadic records of this species are reported at higher latitudes, such as in the South Tyrrhenian Sea (Ustica Island, Vacchi et al. 1998; Ischia Island, Gambi et al. 2016), North and Central Tyrrhenian Sea (Giglio Island, Bianchi and

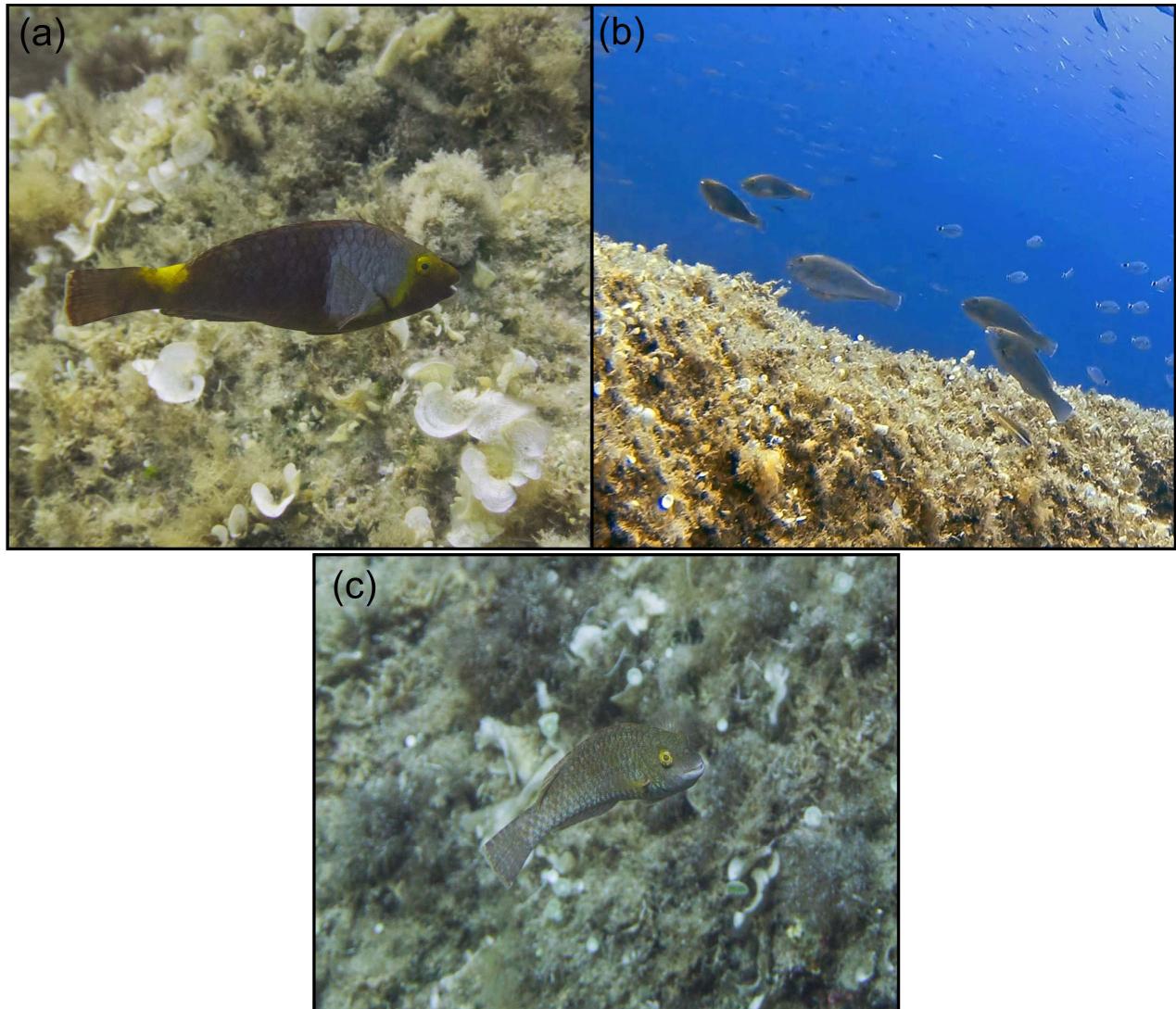


**Figure 1.** The Giglio Island with an indication of sites surveyed by Underwater Visual Census. Green circles are sites where *S. cretense* was not found; Red squares indicate sites where *S. cretense* was recorded (S1: Capo Marino; S2: Le Scole; S3: Secca dei Pignocchi; S4: Faraglione; S5: Scoglio Di Mezzo Franco; S6: Punta delle Saline; S7: Scoglio della Cappa).

Morri 1994; Sardina, Cabiddu et al. 2006), North Ligurian Sea (Gulf of Genoa, Bianchi et al. 2018) and south-east Adriatic Sea (Apulia, Guidetti and Boero 2001, 2002). In this study, we investigated the occurrence and abundance of the parrotfish in the Giglio Island, 26 years since its first record in 1991 (Bianchi and Morri 1994).

## Methods

During the summer 2018 (from late June to the end of August), underwater visual census (UVC) surveys (free diving and snorkeling) were carried out in 13 randomly selected sites, along the whole coast of the island (Figure 1). Two operators estimated the abundances of both adults and subadults of *S. cretense* throughout the survey sites, using 50 × 5 m strip transects end visually estimating the individual size. According to De Girolamo et al. (1999), we divided the counted individuals into adults (estimated Total Length (TL) ≥ 12 cm) and sub-adults (estimated TL < 12 cm). Three replicate transects were completed at each site for a total of 39 transects over the 1–20 m depth range. The main habitat, on which the specimens were recorded, encompassed rocky bottoms (both granitic and calcareous

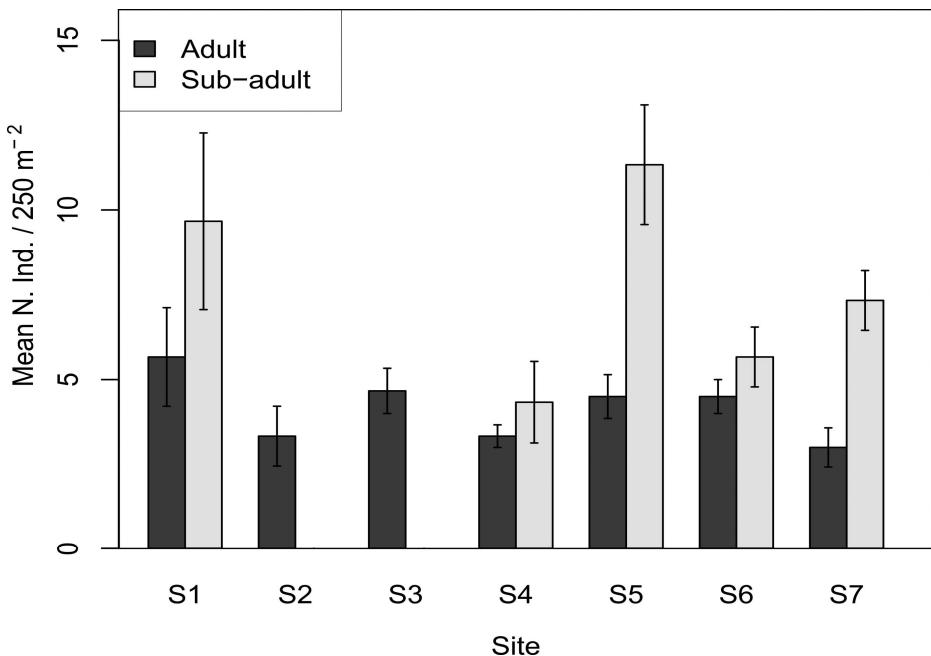


**Figure 2.** *Sparisoma cretense* photographed in the Giglio Island: a) and b) adult individuals; c) a. sub-adult individual. Photo by D. Ventura.

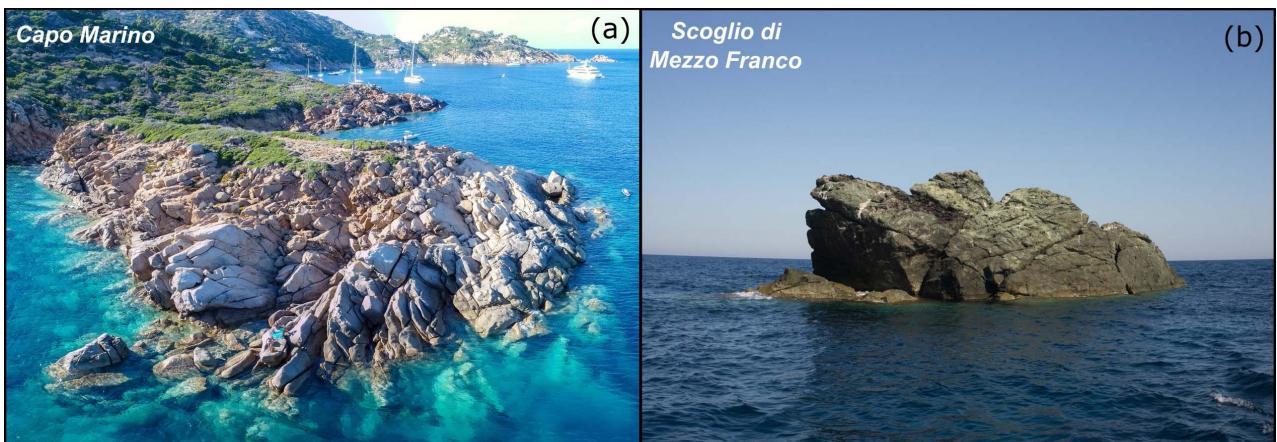
substrata) often colonized by photophilic algae such as *Padina pavonica* and *Cystoseria* spp. Full-HD (1080p) underwater video footages and high resolution (20 Mpix, Sony Alpha 6000 with underwater housing) still images were collected during UVC surveys.

## Results

The presence of *S. cretense* was observed in 7 sites (from S1 to S7, Figure 1) out of 13 surveyed sites, along a total of 21 strip transects. In these locations, both adults ( $N = 86$ , Figure 2a, b) and sub-adults ( $N = 112$ , Figure 2c) were observed, except for two sites, S2 and S3, where only adults were observed. The estimated size range of sub-adults was 6–12 cm TL, and their color pattern was always light-grey livery with marked yellow margins around the eyes. The largest abundances of sub-adults (Figure 3) were recorded along the western coast of the Island, especially in sites S1 (42.348281°N; 10.926194°E, Supplementary material Table S1 and Figure 4a) and S5 (42.356800°N; 10.863947°E, Figure 4b). They were observed always



**Figure 3.** Underwater visual census counts, expressed as mean number ( $\pm$  SE) of fish /  $250\text{ m}^{-2}$  of adult (estimated TL  $\geq 12\text{ cm}$ ) and sub-adult individuals (estimated TL  $< 12\text{ cm}$ ) recorded in the seven survey sites during the period June–August 2018.



**Figure 4.** View of the two sites, Capo Marino (a) and Scoglio di Mezzo Franco (b), where the highest abundance of *S. cretense* were recorded. Photo by D. Ventura.

on rocky substrata marked by a gentle slope ( $< 25^\circ$ ) or near to large boulders ( $> 2\text{ m}$  diameter) at 4–8 m depth with the presence of *Posidonia oceanica* (L.) meadows, whilst no subadults were observed in very shallow waters or in the deepest areas. By contrast, adults were also found on rocky outcrops and steep-sloped ( $25^\circ$ – $45^\circ$ ), rocky headlands up to 20 m depth.

## Discussion

This study provide evidence of the occurrence of an established population of the Mediterranean parrotfish in the North Tyrrhenian Sea after the first species record of Bianchi and Morri (1994) in the same island. The establishment of the population of this warm-water species in the Giglio Island confirms the expansion of its geographical distribution, reinforcing

the occasional observations of this species in the Northwestern sectors of the basin (e.g. Bianchi et al. 2018). In fact, the expansion of the Mediterranean parrotfish was also documented by records of the species in other sectors of the North Mediterranean, such as the North Aegean Sea (Yapici et al. 2016), North Ligurian Sea (Astruch et al. 2016), Eastern Ionian Sea (Nicolaidou et al. 2012) and Eastern Adriatic (Pallaoro and Dulčić 2004). This is a processes that is occurring also outside the Mediterranean, along the Portuguese coasts (Abecasis et al. 2008), which has been interpreted as a biotic response to global warming (Astraldi et al. 1995; Roessig et al. 2004; Azzurro 2008; Azzurro et al. 2011; Bianchi et al. 2018). The population of the Mediterranean parrotfish in Giglio Island might also suggest the ability of this species to spread further across the Western Mediterranean coasts. This species, as well as many other warm-affinity species could take advantage of warmer waters, and hence improved thermal habitat conditions supporting key life processes, such as growth, spawning and recruitment (Albouy et al. 2014; Marras et al. 2015). Further studies are required to track the population dynamics of this northward expanding species through the northern sectors of the Mediterranean basin.

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## Supplementary material

The following supplementary material is available for this article:

**Table S1.** Geographical coordinates (WGS 84 / UTM zone 32N) of the observation sites and the number of *S. cretense* censused per strip transect (50 × 5 m) according to the estimated size class and depth interval. Adult (estimated TL ≥ 12 cm); sub-adult (estimated TL < 12 cm).

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