

Rapid Communication***Bregmaceros nectabanus* Whitley, 1941 (Teleostei: Bregmacerotidae), a new Lessepsian migrant in the Adriatic Sea**Jakov Dulčić¹, Giambattista Bello² and Branko Dragičević^{1,*}¹*Institute of Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia*²*Arion, Via Colombo 34, 70042 Mola di Bari, Italy*Author e-mails: dulcic@izor.hr (JD), giamb.bello@gmail.com (GB), brankod@izor.hr (BD)

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OPEN ACCESS**Abstract**

Two individuals of the Smallscale codlet *Bregmaceros nectabanus* were collected on December 19, 2019 by bottom trawl off Mola di Bari (Italy, Adriatic Sea) at 100 m depth on a muddy bottom. This finding represents the first record of the Smallscale codlet from the Adriatic Sea. Up to now, records of this Lessepsian migrant species have been reported from the Central and Eastern Mediterranean Sea. The present record extends its known distribution northward.

Key words: first record, non-indigenous species, Lessepsian migration, Mediterranean Sea

Introduction

Over the last 150 years, the biodiversity of the Mediterranean Sea has been profoundly influenced by the introduction of non-indigenous species. A major biogeographical change took place with the opening of the Suez Canal in 1869 which connected the Indo-Pacific Ocean with the Mediterranean Sea and allowed the introduction of many species from the Red Sea (Zenetos et al. 2012, 2017; Katsanevakis et al. 2013). Beside the Suez Canal, other important vectors such as shipping, aquaculture and aquarium trade also contribute to the ongoing introduction of non-indigenous organisms into the Mediterranean Sea (Zenetos et al. 2012).

The monogeneric, circumtropical family Bregmacerotidae, commonly known as codlets, comprises 14 valid species (Fricke et al. 2020). The only member of this family known to occur in the Mediterranean Sea is the Smallscale codlet *Bregmaceros nectabanus* Whitley, 1941. However, until 2016, all the Mediterranean occurrences of this species were misidentified and reported under the name *B. atlanticus* Goode & Been, 1886 (Harold and Golani 2016). The main morphological characters that distinguish *B. nectabanus* from *B. atlanticus* and from other congeners are the presence of a distally fimbriate opercular spine, a nearly unpigmented abdomen and a thin dorsolateral longitudinal stripe below the second dorsal fin (Harold



Figure 1. Specimens of the Smallscale codlet *Bregmaceros nectabanus* collected from the Adriatic Sea (near Bari, Italy). Photo by Giambattista Bello.

and Golani 2016). The Smallscale codlet is distributed up to a depth of 350 m (Kulbicki et al. 1994) and is native to the Indo-West Pacific and western Indian Ocean, including the Red Sea (Harold and Golani 2016). According to Harold and Golani (2016), *B. nectabanus* is not present in the Atlantic Ocean, and, according to Masuda et al. (1986), records from the southeast Atlantic should be reassigned to a different species, namely *B. neonectabanus* Masuda, Ozawa & Tabeta, 1986.

The Adriatic Sea is a well-studied semi-enclosed sea, and new marine taxa, including fish, are recorded each year (Dulčić and Dragičević 2013). In this study, we report the first record of *B. nectabanus* in the Adriatic Sea (Dulčić and Lipej 2015; Froese and Pauly 2019).

Materials and methods

Two specimens of the Smallscale codlet *Bregmaceros nectabanus* (Figure 1) were collected on December 19, 2019, around midday, by bottom trawl off Mola di Bari at 100 m depth on muddy bottom (approx. 41.150N; 17.033E). Identification was based on D’Ancona and Cavinato (1965) and Harold and Golani (2016). In reporting the occurrence of *B. nectabanus* in the Adriatic Sea, we followed the protocol for new records suggested by Bello et al. (2014). Both specimens were fixed in 75% ethyl alcohol and each of them deposited in the Zoology Museum of the University of Bari (accession number: MUZAC 6554) and Institute of Oceanography and Fisheries in Split (accession number: IOR – BregNec 420), respectively. Morphometric measurements and meristic counts were obtained from one specimen only (IOR – BregNec 420) because the other specimen was sent to the Museum of Bari before the analysis.

Results and discussion

Morphometric measurements and meristic counts of the analysed specimen are presented in Table 1 and they agree with those provided by Harold and

Table 1. Morphometric and meristic data of the specimen of *Bregmaceros nectabanus* from the Adriatic Sea (IOR – BregNec 420).

Morphometric characters	Length (mm)	Percent in SL (or HL)
Total length	73.4	114.2
Standard length	64.3	100
Head length	12.1	18.8
Pre-dorsal length	25.6	39.8
Pre-anal length	27.0	42.0
Pre-pectoral length	12.7	19.8
Pre-pelvic length	9.4	14.6
Dorsal (2) fin length	39.3	61.1
Anal fin length	34.3	53.3
Pectoral fin length	8.5	13.2
Pelvic fin length	36.0	56.0
Caudal fin length	8.9	13.8
High body depth	12.4	19.3
Low body depth	4.1	6.4
Eye diameter	3.8	31.4% HL
Inter-orbital width	3.6	29.8% HL
Post-orbital length	6.6	54.5% HL
Pre-orbital length	3.1	25.6% HL
Meristic characters	Count	
Dorsal (2) fin soft rays	49 (caution – fin damaged)	
Anal fin soft rays	48 (caution – fin damaged)	
Pectoral fin soft rays	18	
Pelvic fin soft rays	6 small, 3 elongated	
Caudal fin rays (total)	28	

Golani (2016). The main morphological traits which allowed the identification of specimens as *B. nectabanus* were as follows: body elongated, becoming slightly compressed in its ventral part; small head with a blunt snout and relatively large eyes; jaws reaching the vertical line of the middle of the eye; a long ray on top of the head, slightly behind the eye; body with dense pigmentation along the dorsum and a thin brown dorsolateral longitudinal stripe below the second dorsal fin; pelvic fin jugular, with three greatly elongated rays; caudal fin with indented posterior margin; fins without any distinctive markings or pigmentation and nearly unpigmented abdomen; distally fimbriate opercular spine (Figure 2). In contrast, *B. atlanticus* features a simple opercular spine termination, is very darkly pigmented over almost entire body and has a relatively elongated body with typical body depth of 12.4–14.4% (Harold and Golani 2016).

The species was reported under the name *B. atlanticus* for the first time in the Mediterranean Sea by D’Ancona and Cavinato (1965) on the basis of a specimen caught between 1928 and 1930 in the Strait of Sicily, but this record is considered doubtful (Goren and Galil 2006). Reliable records (all reported as *B. atlanticus*) come from eastern Mediterranean in Antalya Bay, Turkey in 2002 (Yilmaz et al. 2004), Kusadasi Bay, Turkey in 2005 (Filiz et al. 2007), the coast of Israel in 2006 (Goren and Galil 2006), the Bay of Iskenderun, Turkey in 2010 (Turan et al. 2011), the Izmir Bay, Turkey in 2011 (Aydin and Akyol 2013), the Saronikos Gulf, Greece in 2014 (Dogrammatzi and Karachle 2015) and the Egyptian coast in 2014 (Rizkalla

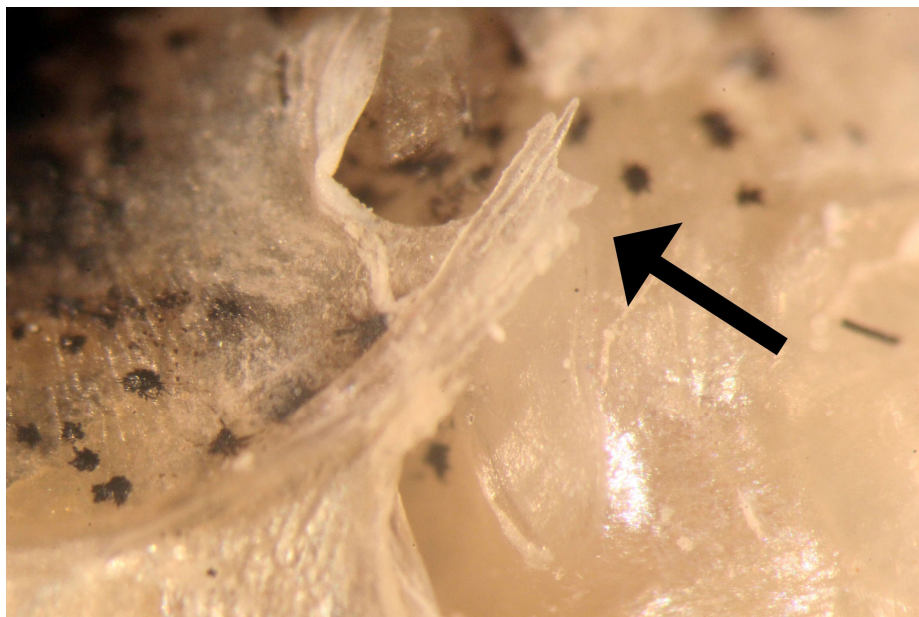


Figure 2. Fimbriate opercular spine of *Bregmaceros nectabanus* from the Adriatic Sea (IOR – BregNec 420). Photo by Branko Dragičević.

and Akel 2015). It was recorded under the name *B. nectabanus* in the Izmir Bay, Turkey in 2014 (Özgül and Akyol 2017), the Patraikos and Kerkyraikos Gulf, Greece in 2016 (Ketsilis-Rinis and Dimitrou 2018) and the Syrian coast in 2018 (Othman and Galyia 2019).

Interestingly, some of the records mentioned above are based on specimens of *B. nectabanus* found in stomachs of other fishes such as *Trachurus trachurus* (Filiz et al. 2007; Othman and Galiya 2019) and the Lessepsian migrant *Saurida lessepsianus* (Yilmaz et al. 2004).

The probable mode of entry of this species in the Adriatic Sea is active dispersal of adult individuals or passive transport of eggs and larvae from nearby areas where this species has established populations (i.e. Ionian Sea) (Ketsilis-Rinis and Dimitriou 2018). Such passive transport could be facilitated by the BiOS mechanism (Bimodal Oscillating System), a physical process that influences the advection of different water mass types towards the Adriatic Sea through the Otranto Strait and is associated with the arrival of various organisms (Civitarese et al. 2010). According to Harold and Golani (2016), *B. nectabanus* entered the Mediterranean Sea through the Suez Canal (Lessepsian migrant), while Özgül and Akyol (2017) considered the possibility of a ballast water introduction, as this species has been detected near large commercial harbours. We should also note that the area of Bari features a commercial harbour; therefore, the possibility of a shipping-related introduction of *B. nectabanus* to the Adriatic Sea cannot be excluded.

The marine biodiversity of the Mediterranean Sea is currently facing substantial community-level changes in both its flora and fauna. Over the past several decades, various factors including climate change, anthropogenic activity and Lessepsian migration have altered the composition of the

Adriatic ichthyofauna. To date, 14 lessepsian fish migrants have been recorded in the Adriatic Sea (Dulčić and Lipej 2015), and the present observations of *B. nectabanus* raises this number to 15.

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