

ON THE OCCURRENCE OF *PSEUDOCARANX DENTEX* (CARANGIDAE) IN THE TURKISH AEGEAN SEA (EASTERN MEDITERRANEAN SEA)

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ABSTRACT

This paper aims to complement and update the data regarding the distribution of uncommon Pseudocaranx dentex throughout the Mediterranean Sea; specifically by revealing the extension of its distribution in the eastern Mediterranean Sea concerning its habitat preference, such as FADs, sea-cage fish farms, and reefs. A total of 86 specimens of P. dentex were observed and one specimen was caught during the period of 2009-2019 from the Aegean Sea. These represent the first well-documented records of P. dentex along the south-eastern coast of the Aegean Sea. Their length ranged from 10 to 70.2 cm in TL. Furthermore, the largest P. dentex (702 mm TL) found in the Mediterranean so far was recorded during this study.

Key words: White trevally, FADs, sea-cages, size, habitat

PRESENZA DI *PSEUDOCARANX DENTEX* (CARANGIDAE) NEL MAR EGEO DELLA TURCHIA (MEDITERRANEO ORIENTALE)

SINTESI

L'articolo ha lo scopo di integrare e aggiornare i dati relativi alla distribuzione nel mare Mediterraneo del carango, Pseudocaranx dentex, specie non comune, rivelando l'estensione della sua distribuzione nel Mediterraneo orientale e considerando le sue preferenze di habitat, come i dispositivi di aggregazione dei pesci (FAD), gli allevamenti ittici in gabbia e le scogliere. In totale sono stati osservati 86 esemplari di P. dentex, e un esemplare è stato catturato nel periodo 2009-2019 nel mar Egeo. Questi avvistamenti rappresentano i primi dati ben documentati di P. dentex lungo la costa sud-orientale dell'Egeo. La lunghezza degli esemplari variava da 10 a 70,2 cm in lunghezza totale (TL). L'esemplare più grande di P. dentex (702 mm TL) trovato finora nel Mediterraneo, è stato avvistato durante questo studio.

Parole chiave: carango, FAD, gabbie d'allevamento, dimensioni, habitat

INTRODUCTION

White trevally, *Pseudocaranx dentex* (Bloch and Schneider, 1801), is a pelagic and reef-associated species which prefers rocky, hard bottom habitats in tropical (40°N - 47°S) seas (Froese & Pauly, 2019). They are generally schooling species but often swim in small groups or solitary at depths from 5 to 238 meters, and they feed on zooplankton and benthic invertebrates (Golani *et al.*, 2006; Bariche, 2012; Froese & Pauly, 2019). Juveniles, in particular, usually inhabit estuaries and shallow waters. Adults form schools and are often associated with rocky bottoms on the continental shelf (Tiralongo, 2018). The common length is 40 cm TL, and the reported maximum length and weight were 122 cm TL and 18.1 kg (Froese & Pauly, 2019).

P. dentex is cosmopolite in tropical and subtropical seas (Golani *et al.*, 2006). In the Mediterranean Sea, *P. dentex* is an uncommon carangid species (Smith-Vaniz, 1986; Bariche, 2012; Tiralongo *et al.*, 2018).

The present paper aims to report on the presence of *P. dentex* throughout the Mediterranean Sea in order to extend the information about its distribution in the eastern Mediterranean Sea concerning its habitat preference, such as Fish Aggregation Devices (FADs), sea-cage fish farms, and reefs. Additionally, the present paper reports the largest *P. dentex* (702 mm TL) recorded to date in the Mediterranean Sea.

MATERIAL AND METHODS

The available information about *P. dentex* was compiled from underwater observations via visual census of wild fish aggregations around experimental FADs and sea-cage fish farms between 2009 and 2017 (Fig. 1A, B and Fig. 2). On August 24th 2019, a specimen of *P. dentex* with a total length (TL) of 702 mm (Fig. 1C) was captured by a spear fisherman in Mersincik Islet, Gökova Bay (Fig. 2) at a depth of 38 m on a rocky bottom (Coordinates: 36°46.046' N-27°28.353' E). This specimen was stored in a freezer.



Fig. 1: (A) *Pseudocaranx dentex* around the sea-cages (photo: A. Özgül); (B) around the FADs (photo: A. Özgül); (C) captured from Mersincik islet, Gökova Bay (photo: O. Akyol).

Sl. 1: (A) Trnoboki okoli ribje kletke (foto: A. Özgül); (B) okoli FAD (foto: A. Özgül); (C) ujet primerek iz otočka Mersincik islet, zaliv Gökova (foto: O. Akyol).

RESULTS AND DISCUSSION

A total of 86 specimens (of which 36 from FADs) of *P. dentex* were observed and one specimen was caught in the period of 2009-2019 from the Aegean Sea. These specimens represent the first well-documented records of *P. dentex* in the south-eastern coastal waters of the Aegean Sea. Their length ranged from 10 to 70.2 cm in TL. Diagnostic characters were identified. All details of the specimens are summarized in Table 1. The colour was greenish blue above, silvery white below, with a yellow stripe along the middle of the sides, and a large black spot on the opercula. The morphometric measurements as a percentage of total length (TL %) and the meristic counts recorded in *P. dentex* captured from Gökova Bay, Aegean Sea, are shown in Table 2. All measurements, counts, and colour patterns determined are in accordance with the descriptions of Smith-Vaniz (1986), Golani *et al.* (2006) and Froese & Pauly (2019).

In the Mediterranean Sea, *P. dentex* has been reported on some fish checklists in the Levant Basin (Gücü & Bingel, 1994; Golani, 1996; Saad, 2005; Akel & Karachle, 2017) as well as the Cyclades archipelago (Giokoumi & Kokkoris, 2013) and the coasts of Izmir (as *Caranx dentex*, Geldiay, 1969). Moreover, *P. dentex* has been recorded in the Adriatic Sea since 1986, and one specimen of 227 mm TL was recently caught by a trammel net near Vis Island at a depth of 20 m (Dulcic *et al.*, 2003). Also, three fish with lengths ranging from 30 to 40 cm TL have been recorded in the south-eastern coasts of Sicily between Siracusa and Avola (Tiralongo *et al.*, 2018).

P. dentex is considered an uncommon fish, and it might occasionally be caught near to shore with trammel nets or gillnets throughout the Mediterranean. Although *P. dentex* appears to be sporadic in the Adriatic and Levantine Seas, it is relatively more common around the FADs and sea-cage fish farms. Afonso *et al.* (2008) determined that *P. dentex* matures at about 30 cm FL, and its spawning season occurred between June and September in the Azores. The juveniles (12-18 cm) especially preferred the FADs at depths of 50 m, whereas, in the deeper FAD area at depths of 100 m they were not observed. Namely, the juveniles preferred shoreline. On the other hand, those fish from the smallest (10 cm) to the larger (30 cm) aggregated around the sea-cage farms (see Table 1). Here, the contribution of the pellet feed must also be attractive as well as sea-cages that act like mega FADs.

However, the largest specimen with 70.2 cm TL was captured with a spear gun over a rocky bottom. This was the largest size of *P. dentex* that had been observed throughout the Mediterranean. This mature specimen and retinue may have been in the course of reproductive migration: Afonso *et al.* (2008) stated that offshore reefs were a preferential spawning habitat for larger *P.*



Fig. 2: The map shows occurring sites of *Pseudocaranx dentex* in the Aegean Sea (□: FADs; ○: sea-cages; red star indicates the sampling location of the huge specimen).

Sl. 2: Zemljevid prikazuje lokalitete, kjer se pojavlja trnobok v Egejskem morju (□: FADs; ○: ribje kletke; rdeča zvezdica označuje vzorčevalno postajo, kjer je bil opažen orjaški primerek).

dentex. At the same time, the capture site was close to a sea-cage fish farm area (i.e., under Güllük Bay), so, the huge specimen had probably reached such a large size due to the high nutritional opportunity around the fish farms.

In fact, *P. dentex* is very rare in the Aegean Sea (only 86 fish during the 17 months in 2009-2019); it is obvious that they are aggregating more where there are existing FADs and/or sea-cage farms. Furthermore, this tropical fish is becoming more abundant due to the effects of global warming in the Mediterranean marine waters (Francour *et al.*, 1994). As indicators of warming in the marine environment, Azzurro (2008)

Tab. 1: Date, location, habitat, depth, distance to land, number of specimens and size range of *Pseudocaranx dentex* in the Aegean Sea. (*it is caught only one sample).**Tab. 1: Datumi, lokalitete, habitat, globina, oddaljenost od kopnega, število primerkov in velikostni razpon trnobokov v Egejskem morju (* samo en primerek ulovljen).**

Date	Coordinates	Habitat	Depth (m)	Distance to land (m)	Number	TL (cm)	Time of observation
July 2009	38°03'11"N-26°59'01"E	FADs	50	2037	4	14	Daytime
Oct. 2009	38°03'11"N-26°59'01"E	FADs	50	2037	2	12	Daytime
Dec. 2009	38°03'11"N-26°59'01"E	FADs	50	2037	6	12	Daytime
Jan. 2010	38°03'11"N-26°59'01"E	FADs	50	2037	3	12	Daytime
Feb. 2010	38°03'11"N-26°59'01"E	FADs	50	2037	4	14	Daytime
Mar. 2010	38°03'11"N-26°59'01"E	FADs	50	2037	5	12	Daytime
Apr. 2010	38°03'11"N-26°59'01"E	FADs	50	2037	4	15	Daytime
May 2010	38°03'11"N-26°59'01"E	FADs	50	2037	4	15	Daytime
Jun. 2010	38°03'11"N-26°59'01"E	FADs	50	2037	2	16	Daytime
July 2010	38°03'11"N-26°59'01"E	FADs	50	2037	2	18	Daytime
30 June 2016	37°10'49"N-27°22'48"E	Sea-cage	60	1500	27	12-20	08:45
26 June 2016	37°10'49"N-27°22'48"E	Sea-cage	60	1500	2	18	09:00
28 Oct. 2016	37°10'49"N-27°22'48"E	Sea-cage	60	1500	5	25-30	09:30
23 Dec. 2016	37°10'49"N-27°22'48"E	Sea-cage	60	1500	2	30	10:30
12 Apr. 2017	37°10'49"N-27°22'48"E	Sea-cage	60	1500	8	10	10:10
15 June 2017	37°17'19"N-27°24'02"E	Sea-cage	50	3000	2	25	10:30
24 Aug. 2019	36°46.046'N-27°28.353'E	Rocky	38	550	5*	70.2	Daytime

Tab. 2: Morphometric measurements as percentage of total length (TL %) and meristic counts recorded in the *Pseudocaranx dentex* captured from Gökova Bay, Aegean Sea.**Tab. 2: Morfometrične meritve kot odstotek celotne dolžine (TL %) in meristična štetja za trnoboka, ki so ga ujeli v zalivu Gökova v Egejskem morju.**

Measurements	Size (mm)	Proportion (TL%)
Total length (TL)	702	
Fork length (FL)	598	85.2
Standard length (SL)	568	80.9
Maximum body depth	195	27.8
Pectoral fin length	185	26.4
Pre-dorsal fin length	230	32.8
Pre-anal fin length	312	44.4
Pre-pectoral length	190	27.1
Head length	181	25.8
Eye diameter	25	3.6
Preorbital length	79	11.3
Meristic counts		
1st Dorsal fin rays		VIII
2nd Dorsal fin rays		I+26
Anal fin rays		II+I+22
Pectoral fin rays		20
Ventral fin rays		I+5
Weight (g)		4126

concluded that the thermophilic tropical and subtropical fishes such as *Epinephelus marginatus*, *Caranx crysos*, *Balistes caprisicus*, *Pseudocaranx dentex*, *Solea senegalensis*, *Sphyrna* spp. have extended their distribution margins by crossing their northernmost or southernmost limits in both Mediterranean and extra-Mediterranean areas.

In conclusion, the Mediterranean Sea is currently becoming warmer, in a manner similar to the waters of the rest of the world (Ben Rais Lasram & Mouillot, 2009). Thus, we can expect an increasing of the rate of introduction exotic and thermophilic species to the Mediterranean. However, further studies are required on overlap between exotic/thermophilic and endemic fish fauna and on their competition.

ACKNOWLEDGEMENTS

This study was financially supported by Scientific and Technological Research Council of Turkey (TUBITAK) [Project number: 107Y163 and 114Y584].

O POJAVLJANJU TRNOBOKA *PSEUDOCARANX DENTEX* (CARANGIDAE) V TURŠKEM EGEJSKEM MORJU (VZHODNO SREDOZEMSKO MORJE)

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POVZETEK

Avtorji želijo s prispevkom dopolniti in nadgraditi poznavanje razširjenosti trnoboka v Sredozemskem morju, še posebej z vidika razširjanja vrste v vzhodnem Sredozemskem morju in njenih habitatnih preferenc do FAD (naprav za privabljanje rib), ribjih kletk in umetnih podvodnih grebenov. V obdobju 2009-2019 so opazovali skupno 86 primerkov *P. dentex* v Egejskem morju, en primerek pa so polovili. Ta potrjuje prvi dobro evidentiran primer pojavljanja trnoboka vzdolž jugovzhodne obale Egejskega morja. Primerki so merili od 10 to 70,2 cm telesne dolžine. Poleg tega je največji primerek trnoboka (70,2 cm telesne dolžine) doslej največji zabeležen primerek v Sredozemlju.

Ključne besede: trnobok, FADs, ribje kletke, velikost, habitat

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