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First Record of Mediterranean Flyingfish *Cheilopogon heterurus* (Rafinesque, 1810) (Teleostei: Exocoetidae) in Saros Bay, Northern Aegean Sea, Turkey

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Abstract

On 25thJune, 2020, One female specimen was caught as discard in sardine fisheries from Saros Bay, northern Aegean Sea. Description of the species was carried out based on morphometric characteristics, using a digital caliper of 0.05 mm accuracy and digital balance of 0.01 g. This paper declares the northernmost extension range of an epipelagic species, *C. heterurus* in Aegean Sea. This report is the first observation for the location. Here, the morpho-meristic features of this species are given in detail.

Saroz Körfezi'nde (Kuzey Ege Denizi, Türkiye) Uçan Balık *Cheilopogon heterurus* (Rafinesque, 1810) (Teleostei: Exocoetidae)'nin İlk Kaydı

Makale Bilgisi

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Öz

25 Haziran 2020 tarihinde olgun bir dişi birey Saroz Körfezi'nden sardalya balıkçılığında ıskarta tür olarak yakalandı. Türün tanımlanmasında morfometrik ölçümler sırasıyla 0.05 mm hassasiyetli bir dijital kumpas ve 0.01 gr. hassasiyetli bir terazi kullanılarak gerçekleştirilmiştir. Bu makale bir epipelajik tür olan *C. heterurus*' un Ege Denizi'ndeki kuzeye doğru yayılışını genişlettiğini bildirmektedir. Bu rapor, lokalite için ilk gözlemdir. Burada, türün morfo-meristik özellikleri detaylı olarak verilmiştir.

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INTRODUCTION

Exocoetidae family consists of 7 genera and 64 species, that two of them live in the Mediterranean. *Cheilopogon* sp. Family members are distinguished from other genera by having a dorsal fin clearly anterior to the anal fin origin. There are two species of *Cheilopogon* previously reported in the Mediterranean: *Cheilopogon exsiliens* (L.) and *Cheilopogon heterurus* (Rafinesque) (Parin, 1986; Bauchot, 1987; Smith, 1997; Quignard and Tomasini, 2000; Van der Land et al., 2001; Parin, 2002). Flying fishes are the most characteristic representatives of fish communities of the epipelagic ocean. *C. heterusus* is also a marine, epi-pelagic and coastal fish species which distributes from eastern Atlantic to western Atlantic: around Bermuda and Gibraltar

and western Mediterranean, eastern Indian Ocean: Australia (Parin, 1986; Bauchot, 1987; Gomon et al., 1994; Randall, 1995; Smith, 1997; Muus and Nielsen, 1999; Bradai, 2000; Bradai et al., 2004; Saveliev et al., 2014). It can fly over long distances. The fish feeds on zooplankton, small invertebrates, and fish larvae (Lewis et al., 1962; Lipskaya, 1987; Masuda and Allen, 1993; Van Noord et al., 2013). As inhabiting the surface layers of the epipelagic zone, it becomes an important component in the diet of predatory fishes, squids, seabirds, and dolphins (Parin 1970). Cervigón and Fischer (1979) and Maigret and Ly (1986) mention that the species commonly measures to 15 cm in total length but might grow as big as 40 cm (total length) . Spawning occurs in schools during summer (Parin, 1986; Muus and Nielsen, 1999; Casazza et al., 2005**).** Mediterranean flyingfish is observed rarely along the Mediterranean Sea and Turkish Coasts (Bradai et al., 2004; Golani, 2005; Lipej and Dulčić, 2010; Bilecenoğlu et al., 2014; Capapé et al. 2016). Bilecenoğlu et al. (2014) mentioned *C. heterurus* in Turkish Seas but, they did not give any morphometric and meristic characters of the species. Since only one record of the species has been reported with some morphometric characters in the eastern Mediterranean of Turkey (Mahmutlar, Alanya), suggesting that the species is rare and occasionally captured in the area (Shakhovskoy and Malikova, 2018), its single and rare occurrence does not support the statement that an established population is locally settled.

There is also a little knowledge about the biology and ecology of the species, thus, further studies are required to monitor the population dynamics of this northward expanding species through the northern parts of the Mediterranean Basin.

The aim of this study is to discuss the distribution of the species in the northern Aegean Sea.

MATERIAL and METHOD

One female specimen (232 mm TL, 80 g.) was caught by-catch in sardine fishing with gill net of 35 mm mesh size from Saros Bay (40º22′11″N, 26º19′16″E). Saros Bay is an inlet of the northern Aegean Sea located in north of the Gallipoli Peninsula in northwestern Turkey. The bay is mentioned for the first time by Lacombe *et al.* (1958) in Pazi (2008) as an area where deep waters can be formed and ventilates the deeper layers of the north Aegean and especially the Lemnos Basin. It is roughly "V" shaped; its length is about 61 km, reaching a depth of 700 m. In the most of the year, the bay is under the influence of northerly winds which cause upwelling over the area (Tokat and Sayın, 2007). As bottom trawl fishing Saroz Bay has been banned in Saros Bay since 2000, the bay can be considered as a unspoilt environment (Cengiz et al., 2011).

C. heterurus was brought for an accurate identification to the laboratory (Figure 1). The sample was identified at species level according to FishBase **(**Parin, 1986; Bauchot, 1987; Randall, 1995**).** For exocetid species, morphometric measurements and meristic counts of the specimen were carried out according to Parin (1986) and Capapé et al. (2016). One specimen was measured using a digital caliper of 0.05 mm accuracy and digital balance of 0.01 g.

After the meristic features were counted under a stereomicroscope having × 20 magnifications, the material was photographed, dissected, fixed in 10% buffered formaldehyde, subsequently preserved in 70% ethanol and then stored in the collections of the Piri Reis Marine Museum, University of Çanakkale.

Figure 1. A female *Cheilopogon heterurus* specimen (24.0 cm TL) captured in Saros Bay, the northern Aegean Sea (Original photo by Tunçer)

RESULTS and DISCUSSION

Specimen was identified as follows: body elongated almost round in cross-section, ventrally flattened, lower jaw not prolonged, upper jaw rounded, teeth small, no palatine teeth, dorsal and anal fin posterior in position, with bases opposite, but anal shorter that dorsal, long pectoral fins, pelvic fins large and in rear position, on the tail, caudal fin forked, lower lobe much longer than upper lobe, dorsal surface blue, belly silvery, dorsal fin grey without spot, pectoral fins greyish with narrow pale posterior margin, caudal fin lobes pigmented. The specimen from Turkey waters almost completely coincides by its characters with the description of *C. heterurus* published by Parin and Belyanina (2000) and Shakhovskoy and Malikova (2018). Total length and weight of this specimen were measured as 28.50 cm and 400 g., respectively. Some morphometric and meristic characters of Mediterranean flying fish are given in Table 1, and colour recorded from the present specimen are in agreement

with Parin (1986), Parin and Belyanina (2000), Louisy (2002), Quéro et al. (2003), Capapé et al. (2016), Shakhovskoy and Malikova (2018), except for dorsal fin rays. This capture confirms the northernmost extension distribution of *C. heterurus* in the Aegean Sea of Turkey.

Of the 9 exocetid species known to date in the Mediterranean Sea (Parin, 1986; Parin, 1996; Parin and Belyanina, 2000; Ben Souissi et al., 2004; Capapé et al., 2016), *C. heterurus* was recorded in the Turkish waters (Bilecenoğlu et al., 2014) with *Hirundichthys rondeletii* (Valenciennes, 1846) and *Parexocoetus mento* (Valenciennes, 1846).

Previously, all of them are also recorded as rare species in Tunusian Waters, Aegean Sea and Levantine Sea (Bradai et al., 2004; Bilecenoğlu et al., 2014). Parin (1986), Louisy (2002), and Capape et al. (2016) noted that the occurrence of remains doubtful throughout the Mediterranean, while Smith (1997) and Capape et al. (2016), and Shakhovskoy and Malikova (2018) noted that *C. heterurus* is rather rare in the western Mediterranean. Following Bilecenoğlu et al. (2014), *H. rondelettii* and *Parexocoetus mento* were recorded from Aegean Sea and Levantine Sea as a rare species which is smiliar to occurence of *C. heterurus.* Although *C. heterurus* is mentioned to be rare in Mediterranean Sea (Parin, 1986, 1996; Smith, 1997; Louisy (2002), *C. heterurus* appears to be probably the single exocetid species successfully established in the Mediterranean Sea (Capapé et al., 2016).

Monitoring of distribution of this species, may give some information to show possible changes on the Mediterranean marine ecosystems and to form stable populations outside its own region such as northern Aegean Sea.

Table 1. Morphometric (mm) and meristic features of Mediterranean flyingfish, *Cheilopogon heterurus* specimen captured from Saros Bay on 25thJune, 2020.

References	**Capapé et al. (2016)**			**Shakhovskoy and Malikova (2018)**	**Present study***
N	1	2	3	1	1
Total length (TL)	231	380	400	-	232
Fork length (FL)	185	315	320	-	194
Standard length (SL)	177	305	311	207	190
Snout length	8	15	16	-	2
Head length (HL)	37	60	61	-	35
Body depth (BD)	29	68	66	-	25
Prepectoral length (PPL)	36	65	63	-	40
Predorsal length(PDL)	123	210	214	-	132
Preanal length (PAL)	137	240	244	-	50
Length of pectoral fin	121	213	216	-	132
Length of pelvic fin	68	95	96	-	50
Length of anal fin	13	21	22	-	17
Length of dorsal fin	19	40	42	-	19
Interorbital length (IOL)	17	27	26	-	16
Eye diameter(ED)	12	22	23	-	14
D	13	12	12	14	11
A	9	9	9	10	11
V	6	6	6		6.0
P	16	15	15	I+14	I+15
Predorsal scales	24	24	-	33	32

Table 1. Morphometric (mm) and meristic features of Mediterranean flyingfish, *Cheilopogon heterurus* specimen captured from Saros Bay on 25thJune, 2020. (*Continue*)

Lateral line				8	8
Weight (g.)	89	396	377	317	400
Weight of gonad (g.)	-	-	-	-	6.76

CONCLUSIONS

In conclusion, global heating of seas is an important factor that leads the reconstruction of the Mediterranean marine biodiversity and an settlements of fish populations (Bianchi and Morri, 2004; Lejeusne et al., 2010) Although the presence of *C. heterurus* does not clearly indicate that there is an established population in the northern Aegean coast of Turkey, its distribution into the area is not a single event and ongoing process and might be observed in different sections of the northern Aegean Sea in the future.

Unfortunately, there is also a little knowledge about the species biology and ecology, thus, further studies are required to track the population dynamics of this northward expanding species through the northern parts of the Mediterranean basin with certain oceanographic characteristics (temperature, dissolved oxygen, salinity, surface circulation, water masses, and biological productivity) (Shakhovskoy, 2018).

According to the IUCN Red List, *C. heterurus* is in (LC) Least Concern group (Collett et al., 2015). Although it is not targeted by fishing gear or fishing technique, and is rarely recorded by the commercial fishing industry (Moravec and Garibaldi, 2003), however, with regard to its attractive appearance and harmless, *C. heterurus* has a potential interest of fisheries in general (Fisher et al., 1987). It is also placed in the epipelagic food chain where it is the preferred prey of predators such as *Coryphaena hippurus*, *Thunnus thynnus*, and *Prionace glauca* (Parin, 1970; Massutí et al., 1998; Araújo and Chellappa, 2002; Uygun and Hoşsucu, 2018) as a member of flyingfishes. Moreover, pelagic seabirds from family Laridae, squids, and dolphins are also known to feed on flyingfish (Parin, 1970; Pinkas et al., 1971; Hensley and Hensley, 1995; Massuiti et al., 1998).

Besides, it is important for diversity of Saros Bay ichthyofauna. The effective presence of *C.heterurus* in the Saros Bay might be monitored to check the establishment of the Mediterranean flying fish in the area continuously and thus, to understand it's the biology and ecology of the species in the locality.

COMPLIANCE WITH ETHICAL STANDARDS

a)Authors' contributions: Author ST sampled the species, described its morphometric characters and photographed the specimen, HTK wrote the text and formed the table. All of the authors read the final position of the text and confirmed it.

b)Conflict of interest: The authors declare that they have no conflict of interest.

c)Ethical approval: All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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