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ADDITIONAL RECORDS AND CONFIRMED OCCURRENCE OF MEDITERRANEAN FLYINGFISH *CHEILOPOGON HETERURUS* (OSTEICHTHYES: EXOCETIDAE) FROM THE COAST OF TUNISIA (CENTRAL MEDITERRANEAN)

SUMMARY

The authors present in this paper the captures of new specimens Mediterranean flyingfish *Cheilopogon heterurus* (Rafinesque, 1810) off the Tunisian coast. These captures are the northernmost extension range of the species in the area and confirm its local occurrence. The existence of a sustainable population in the Tunisian waters cannot be ruled out, showing that *C. heterurus* is the most common exocetid species known to date in the Mediterranean Sea.

INTRODUCTION

Mediterranean flyingfish *Cheilopogon heterurus* (Rafinesque, 1810) appears to have a worldwide distribution, it is reported from the Pacific Ocean, in Australian waters (Gomon *et al.*, 1994) and from the western Atlantic in the Gulf of Mexico (Smith, 1997). By contrast, the species is sporadically captured in some areas of the northeastern Atlantic, such as Denmark, southern Norway, southern England and France (Parin, 1986). South the Strait of Gibraltar, *C. heterurus* is reported off Morocco (Lloris and Rucabado, 1998), Mauritania (Maigret and Ly, 1986), probably off Senegal to the Gulf of Guinea (Blache *et al*., 1970).

Parin (1986) reported the occurrence of *Cheilopogon heterurus* only in the western Mediterranean Basin, since the species extended its distribution eastward and at present, is recorded in the Adriatic Sea (Lipej and Dulciç, 2010), the coast of Turkey (Bilecenoglu *et al*., 2014) and the eastern Levant Basin (Golani, 2005; Saad, 2005). Off the Maghreb shore, the species was reported off Morocco (Lloris and Rucabado, 1998) and Algeria (Dieuzeide *et al*., 1954), while the first record in the Tunisian waters occurred in February 2001 from the southern Gulf of Gabès (Bradai *et al*., 2004). Since, no record of *C. heterurus* was reported in the Tunisian, suggesting that the species was rare and occasionally captured in the area; additionally, this single occurrence does not constitute a sufficient support to state that a sustainable population was locally established.

However, investigations regularly conducted off the northern Tunisian coast and the Gulf of Tunis allow to capture several specimens of *Cheilopogon heterurus* which are described in the present paper. Concomitantly, we comment and discuss on the distribution of the species locally and in the Mediterranean Sea.

MATERIAL AND METHODS

This study is based on captures of several specimens of *Cheilopogon heterurus*, captured off the northeastern Tunisian coast. All collected specimens were measured to the nearest millimetre and weighed to the nearest gram. A first specimen, measuring 231mm in total length (TL) and weighing 89g, was caught on 18 March 2015, in waters surrounding Zembra Island, located in the northern region of the Gulf of Tunis (Fig. 1), by gill-net of 35mm mesh size, on rocky bottoms at a depth of 5m approximately, together with sparid and carangid species, by 37°10'46N and 10°87'97 E. The specimen was preserved in 10% buffered formaline and deposited in the Ichthyological Collection of the Faculty des Sciences from Tunis, receiving the catalogue number FST-Che-het-01.

On 09 June 2015, 5 other specimens were captured off Ras Jebel, city located 50km north of Tunis, their TL ranged between 344 and 400mm and their weight between 256 and 396g. All specimens were caught by gill-nets of 28mm mesh size, on rocky bottoms partially covered with algae, together with sparid and labrid species, by 37°14'25.42»N and 10°09'37.49»E. Two specimens were preserved in 10% buffered formaline and deposited in the Ichthyological Collection of the Faculty des Sciences from Bizerte, receiving the catalogue numbers, FSB- Che-het-01 (Fig. 2), and FSB- Che-het-02, respectively.

Morphometric measurements and merisctic counts were carried out for 3 specimens, following Parin (1986) for exocetid species and Ben Souissi *et al*.

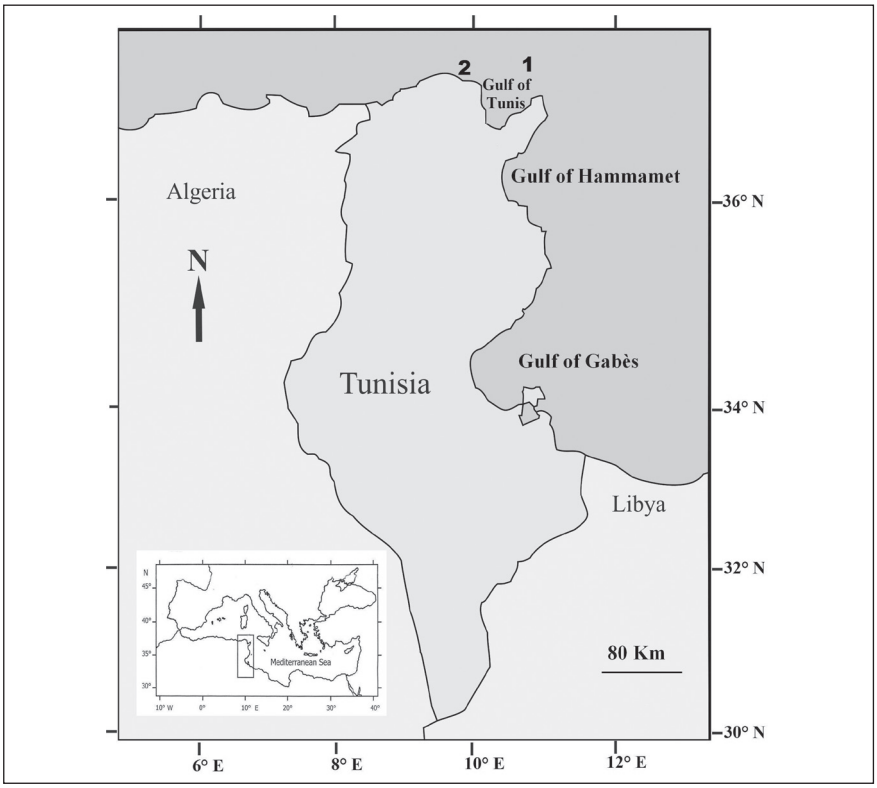

Fig. 1. Captures sites of *Cheilopogon heterurus* from the coast of Tunisia. 1. Off Zembra Island. 2. Off Ras Jebel.

Fig. 2. *Cheilopogon heterurus* caught off Ras Jebel (Ref. FSB-Che-het-01), scale bar = 90mm.

(2005) for spotfin flyingfish *Cheilopogon furcatus* (Mitchill, 1815); they are summarized in Table 1.

RESULTS AND DISCUSSION

All specimens were 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, with 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. Morphology, measurements, counts given inTable 1, and colour recorded from the present specimens are in total agreement with Parin (1986), Louisy (2002) and Quéro *et al.* (2003). These captures are the northernmost extension range of *Cheilopogon heterurus* in the Tunisian waters.

Parin (1986, 1996) and Louisy (2002) noted that the occurrence of remains doubtful throughout the Mediterranean and needs confirmation, while Smith (1997) noted that *Cheilopogon heterurus* is rather rare in the western Mediterranean. These additional captures confirm the occurrence of the species in the Tunisian waters, and suggest a possible migration toward northern area, due to the fact that the first Tunisian record occurred in the southern Gulf of Gabès (Bradai *et al*., 2004). Our investigations were actively supported by local experienced fishermen who are aware of fishing grounds in the area, and, in the wake of this cooperation, they provided us some specimens herein presented and informed us that *C. heterurus* is abundantly caught in March and April. Such patterns contradict Parin (1986, 1996), Louisy (2002) and Smith (1997), and our observations suggest that a sustainable population of *C. heterurus* is locally present. Of the 9 exocetid species known to date in the Mediterranean Sea (Parin, 1986; Ben Souissi *et al*., 2005), 5 were recorded in the Tunisian waters (Bradai *et al*., 2004; Ben Souissi *et al*., 2005). Following Bradaï (2000), the occurrence of Oceanic two-wings flying fish, *Exocetus volitans* Linnaeus, 1758 only reported in the area by Vinciguerra (1884) remains doubtful, black-wing flying fish *Hirundichthys rondelettii* (Valenciennes, 1846) is locally considered as very rare. Two alien species were recently recorded in the area, African sailfin flyingfish *Parexocoetus mento* (Valenciennes, 1846) coming from the Red Sea through Suez Canal, a single specimen was recorded in the area (Bradai *et al*., 2004), and two specimens of *C. furcatus* found by Ben Souissi *et al.* (2005). It appears that *C. heterurus* is probably the single exocetid species successfully established in the area,

References	FST-Che-het-01		FSB- Che-het-01		FSB- Che-het-02	
Measurements	mm	%SL	mm	%SL	mm	%SL
Total length (TL)	231	130.5	400	128.6	380	124.6
Fork length (FL)	185	104.5	320	102.9	315	103.3
Standard length (SL)	177	100.0	311	100.0	305	100.0
Head length (HL)	37	20.9	61	19.6	60	19.7
Interorbital space	17	9.6	26	8.4	27	8.9
Eye diameter	12	6.8	23	7.4	22	7.2
Snout length	8	4.5	16	5.1	15	4.9
Caudal fin height	44	24.9	63	20.3	55	18.0
Space snout - vent	131	74.0	210	67.5	205	67.2
Pectoral fin length	121	68.4	216	69.5	213	69.8
Pectoral fin base	14	7.9	26	8.4	25	8.2
Dorsal fin length	19	10.7	42	13.5	40	13.1
Dorsal fin base	34	19.2	61	19.6	60	19.7
Pelvic fin length	68	38.4	96	30.9	95	31.1
Anal fin length	13	7.3	22	7.1	21	6.9
Anal fin base	19	10.7	30	9.6	30	9.8
Caudal fin upper lobe length	44	24.9	64	20.6	62	20.3
Caudal fin lower lobe length	55	31.1	99	31.8	95	31.1
Body height	29	16.4	69	22.2	70	23.0
Body depth	29	16.4	66	21.2	68	22.3
Pre-pectoral length	36	20.3	67	21.5	65	21.3
Pre-dorsal length	123	69.5	214	68.8	210	68.9
Pre-anal length	137	77.4	244	78.5	240	78.7
Counts						
Dorsal fin soft rays	13		12		12	
Pectoral fin soft rays	16		15		15	
Pelvic fin soft rays	6		6		6	
Anal fin soft rays	9		9		9	
Gill-rakers	24		-		24	
Pre-dorsal scales	37		-		38	
Weight in gram	89		376		396	

Table 1. Morphometric measurements (mm) and as percent of standard length (%SL) recorded in three specimen of *Cheilopogon heterurus* collected off Zembra Island (Ref. FST-Che-het-01), and off Ras Jebel (Ref. FSB- Che-het-01 and FSB- Che-het-02).

the core of the species being the western Mediterranean Basin, although Quignard and Tomansini (2000) did not classify it as an endemic species. On the other hand migrations of *C. heterurus* from the Mediterranean to eastern Atlantic areas cannot be totally ruled out.

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