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— SHORT COMMUNICATION —

First record of *Tylosurus crocodilus* (Péron & Lesueur 1821) (Pisces: Belonidae) in the Mediterranean (North Aegean Sea, Greece)

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The presence of *Tylosurus crocodilus* is reported for the first time in the Mediterranean Sea (North Aegean Sea). This adds another record to the existing list of Lessepsian fish immigrants. One individual was caught on the 25th of July 2003 off the Gerakini beach area (Chalkidiki Peninsula). Its total length and weight were 91.5 cm and 802.5 g, respectively. Its stomach was empty and no gonads were found. Scale reading indicated three annual rings, the first of which was not apparent for all scales examined.

Key words: *Tylosurus crocodilus*, Mediterranean Sea, Aegean Sea, Lessepsian migration, ichthyofauna.

INTRODUCTION

The composition of the Aegean Sea ichthyofauna is still very interesting, because of the new species that are frequently found. The presence of new species in the Eastern Mediterranean and the Aegean has increased and it is attributed to movement of species from the rest of the Mediterranean, as for example *Diaphus metopoclampus* (Sinis & Koukouras, 1995) and *Lampris guttatus* (Sinis, 2004), but mainly to Lessepsian immigrants from the Red Sea. Papakonstantinou (1988) reported 13 Lessepsian immigrants (*Siganus rivulatus, Siganus luridus, Lagocephalus spadiceus, Stephanolepis diaspros, Upeneus moluccensis, Leiognathus klunzingeri, Saurida undosquamis, Pempheris vanicolensis, Hemiramphus far, Sargocentron rubrum, Alepes djeddaba, Atherinomorus lacunosus* and *Parexocoetus mento*). Golani *et al*. (2002) reported 59 species, which migrated from the Indo-Pacific Ocean, via the Suez Canal, and colonized the Mediterranean Sea. Karachle *et al*. (2004) calculated the time between the first report of some Lessepsian species in the Mediterranean and the first report in the South Aegean Sea, as well as the time between the first report in South Aegean and the first report in North Aegean Sea. Thus, the above researchers found that *L. klunzingeri* needed 43 years in order to move from South to North Aegean, while *Fistularia commersonii* hardly needed one year. The present work reports the appearance of *Tylosurus crocodilus*, a new Lessepsian fish immigrant in the Mediterranean Sea (North Aegean). Until now, only two species of the same genus, *T. acus* and *T. choram*, were known to be present in the Mediterranean (Collette & Parin, 1986).

MATERIALS AND METHODS

The presence of *Tylosurus crocodilus* in North Aegean Sea was based on an individual, which was found dead with a deep lesion in the abdomen on 25th of July 2003 in the beach of Gerakini in Chalkidiki (Fig. 1). Mrs Anna Tragaki, who was fishing in the area, made the recovery. The species identification was made according to the descriptions of Smith (1965), Collette & Parin (1986), Robins & Ray (1986). The sample has been deposited in the

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FIG. 1. Map indicating the location (★) where *Tylosurus crocodilus* was found.

TABLE 1. Meristic and morphometric characters of the single specimen of *Tylosurus crocodilus* found in the North Aegean Sea

Meristic characters	
Number of rays of dorsal fin (D)	24
Number of rays of anal fin (A)	23
Number of rays of pectoral fins (P)	14
Number of rays of pelvic fins (V)	6
Morphometric characters (in cm)	
Total Length (TL)	91.5
Fork length (FL)	87.4
Standard length (SL)	82.9
Somatic length (BL)*	58.3
Head length	25.2
Depth of dorsal fin (D)	5.06
Depth of anal fin (A)	5.46
Length of pectoral fin (P)	6.36
Length of pelvic fin (V)	5.20

* BL = distance from the margin of the branchial cover to the base of the caudal fin (Golani *et al*., 2005).

Museum of the Laboratory of Ichthyology, School of Biology, Aristotle University of Thessaloniki, Greece.

RESULTS AND DISCUSSION

The species *Tylosurus crocodilus* (hound needlefish) belongs to the family Belonidae. According to Tortonese (1970) the name of the genus (*Tylosurus*) derives from the Greek words knob (tylos) and tail (urus) that refer to the lateral keel present at the stalk of the tail.

Description

Body cylindrical, ridge aquamarine, silver-coloured sides and yellow at regions, abdomen white, fins at a large part yellow (P and C dark-coloured), with distinct black lateral keel at the stalk of the tail. Dorsal fin arched hollowed and with rounded lobes, caudal fin deeply forked and heterocercal (down lobe longer), anterior rays of fins much longer, last rays of dorsal fin pressed reach the base of caudal fin (Fig. 2). The meristic and morphometric characters of the unique sample are given in Table 1.

The information that can be found in the bibliography for the identification of *T. crocodilus* is limited, so it was difficult to identify the sample. For this reason, the characteristics of the two congeneric species, *T. acus* and *T. choram* (which already exist in the Mediterranean), those of *T. crocodilus* from the literature and finally the characteristics that resulted from the study of the specimen found in North Aegean are mentioned in Table 2. From the comparison of the characteristics of the specimen found with those of the three specimens, we can conclude that:

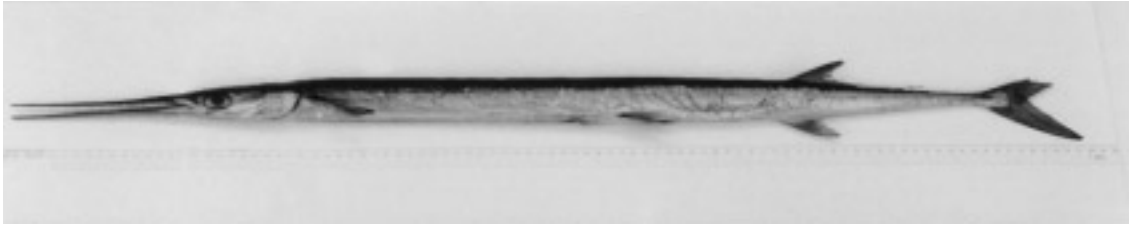

FIG. 2. The single specimen of *Tylosurus crocodilus*, caught in the North Aegean Sea.

TABLE 2. Comparison of the characteristics of the single specimen of *Tylosurus crocodilus* found in the North Aegean with those of *T. crocodilus*, *T. acus* and *T. choram* from the literature

Characteristics	***T. acus*[1]**	***T. choram*[2]**	***T. crocodilus*[3]**	**Specimen (N. Aegean)**
Number of rays "D"	21-27	19-24	19-25	24
Number of rays "A"	18-24	19-22	19-24	23
Number of rays "P"	12-14	13-15	?	14
BL/Length "P"	8.0-12.4	6.6-8.3	?	9.2
BL/Length "V"	10.0-14.1	7.3-10.6	?	11.2
BL/Depth "A"	9.7-11.7	5.5-8.0	?	10.7
BL/Depth "D"	10.5-13.3	5.4-10.6	?	11.5
Snout/Head	2	?	~ 1.5	1.6
BL/Snout	?	2.3-3.1	3.0-4.3	3.7
BL/Head	3.1-3.3	1.6-2.0/2.6-3.1	2.0-2.6	2.3
Length of jaws	upper < lower	?	?	upper = lower
Position of "D" and "A"	?	"D" opposite of "A"	"D" almost above the 2nd ray of "A"	"D" almost above the 2nd ray of "A"
Teeth	?	various sizes	same size	same size

[1] Bauchot & Pras (1980); Collette & Parin (1986); Robins & Ray (1986)
[2] Collette & Parin (1986); Golani *et al*. (2005)
[3] Smith (1965); Collette & Parin (1986); Robins & Ray (1986); Froese & Pauly (2002)

T. acus:

1. The snout of this species is shorter from the snout of the specimen found. The snout of *T. acus* is twice as long as the rest of the head, while the snout of the specimen found is roughly 1.6 times longer than the rest of the head.
2. The ratio of the head length to the body length is 3.1 - 3.3 for *T. acus* and 2.3 for the sample.
3. The upper jawbone is shorter than the lower one in *T. acus*, while in the specimen found they are equal.

T. choram:

1. The number of rays of the fin "A" is smaller than that of the specimen found.
2. The ratio of length of fin "P" to the body length is 6.6-8.3, while in the specimen found it is 9.2.
3. The ratio of length of fin "V" to the body length is 7.3-10.6, while in the specimen found it is 11.2.
4. The ratio of height of fin "A" to the body length is 5.5-8.0, while in the specimen found it is 10.7.
5. The ratio of the height of fin "D" to the body length is 5.4-10.6, while in the specimen found it is 11.5.
6. The ratio of the beak length to the body length is 2.3-3.1, while in the specimen found it is 3.7.
7. The ratio of the head length to the body length is 1.6-2.0, while in the specimen found it is 2.3.
8. Fins "D" and "A" are found in opposite sides, while in the specimen found the base of fin "D" is roughly above the 2nd ray of fin "A".
9. The teeth are variable in size, while in the sample they are all of the same size.

T. crocodilus: all the characteristics are in accordance with those of the specimen found.

Moreover, Collette & Parin (1986) give three more characteristics for *T. crocodilus*, which were recognized in the specimen found: fin "V" is roughly in the middle of the distance between the eye and the base of fin "C", the tongue is rough and there are no teeth on the vomer. According to the above it is obvious that the specimen found in the North Aegean belongs to *T. crocodilus*.

Distribution

Tylosurus crocodilus is found in the Indo-Pacific Ocean, in the Red Sea, in South Africa, in the French Polynesia, in North Japan, in the Southern New Wales and in Australia (Froese & Pauly, 2002). The fact that the presence of the species in the Mediterranean had not been reported until today, as well as its rarity (only one individual was found), can be probably attributed to the limited number of individuals that passed through the Suez Canal, to recent immigration and to lack of related studies. This

is supported from the biology of the species, which lives either solitary or in small schools (Froese & Pauly, 2002), but also from the information that the samplings carried out by the two fish research institutes of Greece (Greek Center of Marine Researches and Fisheries Research Institute) are limited in the demersal fauna (Papakonstantinou & Kallianiotis, personal communication). On the contrary, *T. crocodilus* is exclusively an open sea species, reaching depths of 13-15 m (Smith, 1965; Froese & Pauly, 2002).

The species is distributed in the tropical and hot temperate waters (Robins & Ray, 1986), and this perhaps is another reason (beyond the search for food) of its immigration, i.e. the significant rise of temperature in the Eastern Mediterranean Sea in recent years. It is remarkable that recently another Lessepsian fish immigrant, *Fistularia commersonii* (Karachle *et al*., 2004), was also found at the entry of the same gulf (Toronaios) where the *T. crocodilus* specimen was found. In the past, Lessepsian immigrants had never been found northerly of the island of Chios (Papakonstantinou, 1988). The same study reports that the subtropical character of South Aegean is also documented from the presence of Lessepsian immigrants that were found in the Dodecanese, the Cyclades, Saronikos Gulf and the island of Chios. Por (1978) and Stergiou *et al*. (1997) believe that the colonization of the Eastern Mediterranean Sea by immigrants from the Red Sea is a continuous process. This implies that the ecosystems of the Eastern Mediterranean have the capability to accept new links in the trophic web.

Biology

The unique specimen that was found had a total length of 91.5 cm and a total weight of 802.5 g. Other studies have reported lengths of 150 cm and weights of 6.35 (Froese & Pauly, 2002) and 4.5 kg (Robins & Ray, 1986). In the specimen of Gerakini beach, no gonads were found that could help sex it. The species is considered a wild predator and very devastating for the small fishes (Robins & Ray, 1986); however the stomach of the specimen was empty. Examination of the scales revealed that they are small cycloid, and three annual rings were identified, of which the first one was not clear in all scales examined. Although *T. crocodilus* is considered a palatable fish, its market is limited due to the green-coloured flesh (Froese & Pauly, 2002).

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