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SHORT COMMUNICATION

Unusual presence of juveniles of the Indo-Pacific blackmouth splitfin *Synagrops japonicus* in the southwest Mediterranean coast

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This paper reports additional records of the Indo-Pacific fish Synagrops japonicus *(Doderlein, 1884) in Western Mediterranean. Twenty juveniles of this species ranging from 4 to 4.8 cm (TL) were caught in Annaba Bay, Algeria, using beach seine, in Summer of 2011 (9 specimens, 4 ≤ TL ≤ 4.6 cm) and 2012 (11 specimens, 4.2 ≤ TL ≤ 4.8 cm). Some hypotheses on the origin of this unusual presence are discussed.*

Key words: *Synagrops japonicus*, new record, morphology, Mediterranean, Algeria

INTRODUCTION

The Mediterranean Sea has experienced intrusion of many exotic plant and animal species over the past decade (QUIGNARD, 2011; ZENETOS *et al*., 2012). Fifty-one fish NIS (40.5%) were recorded for the first time in the Mediterranean Sea after 2001 i.e. during a period of 11 years, whereas the remaining 75 species (59.5%) were recorded in a span of 118 years (1882 to 2000) (ZENETOS *et al*., 2012). The origins of these species are either Atlantic (Herculean immigrants) *via* the Strait of Gibraltar or Indo-Pacific (Lessepsian migrants) *via* the Suez Canal. Between 1955 and 2010, 63 Herculean immigrants and 81 Lessepsian were identified by QUIGNARD (2011). According to this author, the number of exotic bony fish in the western Mediterranean basin could reach up to 42 species (32 Herculean and 10 Lessepsian). In the Algerian basin, only 5 exotic species are reported to date: *Acanthurus monroviae* (HEMIDA *et al.,* 2004), *Solea senegalensis* (CHAOUI & KARA, 2004), *Fistularia commersonii* (KARA & OUDJANE, 2009), *Hemiramphus far* (KARA *et al.,* 2012) and *Lagocephalus sceleratus* (KARA *et al*., 2015).

In the Mediterranean Sea, the Acropomatidae family is known by a single female specimen of the species *Synagrops japonicus* (TL = 30 cm), recorded for the first time in the Ligurian sea, in commercial fisheries carried out between 250 and 450 m of depth (ORSI-RELINI, 1990). This species is benthopelagic and have a depth range of 100-800m. *Synagrops japonicus* has no direct economic value, but it is used in the manufacture of fish flour. Its maximum total length does not exceed 35 cm (FROESE & PAULY, 2014).

We present in this work additional record of *S. japonicus* in the Mediterranean. Twenty juveniles have been caught in the Gulf of Annaba, in eastern Algeria, and are characterized morphologically.

MATERIAL AND METHODS

Diurnal and nocturnal experimental fishing were carried out monthly between June 2012 and May 2013 along three beaches in the western Gulf of Annaba, at approximately 4 km from the commercial port of Annaba (Fig. 1). Twenty specimens of *S. japonicus* were captured by day at 1 m depth: 9 specimens were caught on June 24th, 2011 ($4 \leq TL \leq 4.6$ cm, $0.4 \leq TW \leq 1.13$ g) and 11 specimens were caught on July 30th, 2012 ($4.2 \leq TL \leq 4.8$ cm, $0.68 \leq TW \leq 1.22$g). Fishing was conducted using a beach seine (Length = 10 m, height = 1.2 m, mesh size = 4 mm) on sandy bottoms near rocky relief. Temperature and salinity were between 19.4 and 25.8 °C and 36.9 and 38.1 PSU, respectively. For fished specimens, the identification was based on morphometric, meristic and descriptive (shape of otholits) characters; using FISCHER & BIANCHI, 1984; MOCHIZUKI & SANO, 1984 and PROKOFIEV, 2007. Pearson's correlation was used to test the correlation of measured characters of sampled specimens.

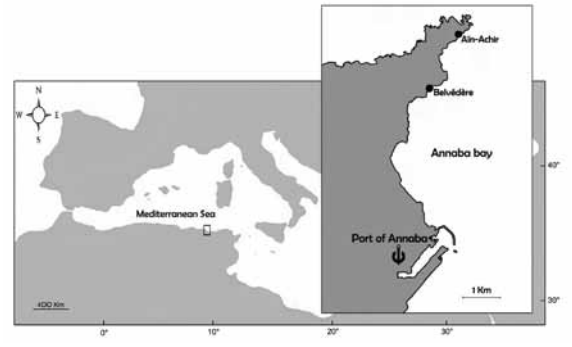

Fig. 1. Map pointing out the capture area of Synagrops japonicus on Algerian coasts

RESULTS

During identification, the first step was to classify the specimens to their family membership (Acropomatidae) from other morphologically related families (Apogonidae, Epigonidae, Moronidae) that are present in our region (FISCHER *et al.,* 1987, LOUISY, 2005, DERBAL & KARA, 2001, 2010). Indeed, the Acropomatidae are distinguished from Apogonidae by the absence of a double-edged preoperculum and a difference in the number of soft rays in the anal fin (II, 8-18 for Apogonidae and II, 7 for Acropomatidae). Unlike Epigonidae, they have a narrow jaw, ctenoid scales, and a lateral line that extends onto the caudal fin. Unlike the Moronidae, the Acropomatidae are characterized by the absence of 2 spines on the opercle, a spine and 9 rays on the second dorsal fin (1 spine and 11-14 soft rays of the second dorsal fin in Moronidae) and by 2 spines on the anal fin (3 in Moronidae).

The Acropomatidae family is composed of 8 genera. The genus Synagrops is clearly distinguished from the five other genera, i.e. Acropoma, Verilus, Malakichthys, Apogonops and Doederleinia, by the presence of two clearly separated dorsal fins with an inter-dorsal space which represents 15.16% of the standard length. The Neoscombrops genus is represented by 4 species: *N. annectes, N. cynodon, N. atlanticus* and *N. pacificus*. Unlike *S. japonicus*, N. *annectes* has 2 dorsal fins welded to the base. N. *cynodon, N. pacificus* and *N. atlanticus* differ from *S. japonicus* by the presence of 3 anal spines (2 in *S. japonicus*) (MOCHIZUKI & SANO, 1984). The genus Pseudohowella which contains only one species (*P. intermedia*) is characterized by the presence of 16 caudal vertebrae (PROKOFIEV, 2007) while the genus *Synagrops* contains 13 caudal vertebrae.

Among the genus *Synagrops*, there are 11 species (STELLA-MEJÍA, 2001). The feature of inter dorsal space allowed us to distinguish *S. japonicus* from other species of the same genus whose dorsal fins appear more or less joined together with the exception of *S. pseudomicrolepsis*. The radial formula of this latter species (D1: IX, D2: I-10, A: II 9) distinguishes it from *S. japonicus* (D1: IX, D2: I-9, A: II-7). The identification of *S. japonicus* specimens we fished is reinforced by the presence of cycloid scales (FISCHER & BIANCHI, 1984), by the shape of their otoliths similar to that of specimens caught in the Philippines (RIVATON & BOURRET, 1999) and the number of vertebrae (n = 25) (Fig. 2) (FISCHER & BIANCHI, 1984).

As described by FISCHER & BIANCHI (1984) and ORSI-RELINI (1990), the specimens fished in

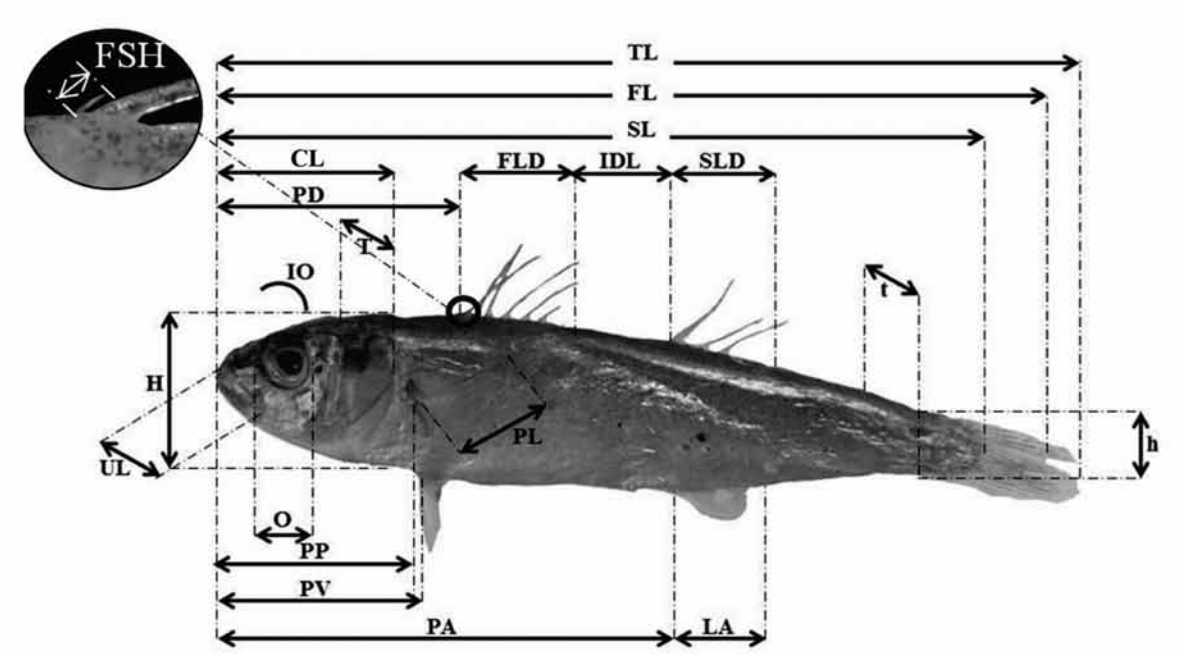

Fig. 2. Species' morphology and metric characters measured of Synagrops japonicus: total length (TL), fork length (FL), prepectoral length (PL), first dorsal fin base length (FLD), second dorsal fin base length (SLD), inter-dorsal length (IDL), anal fin base length (LA), first dorsal spine height (FSH), standard length (SL), maximum body height (H), maximum body thickness (T), preanal distance (PA), prepectoral distance (PP), preventral distance (PV), predorsal distance (PD), cephalic length (CL), upper jaw length (UL), eye diameter (O), interocular distance (IO), minimum body thickness (t) and minimum body height (h)

coastal waters of Annaba are characterized by oblong body which are more or less compressed, and have 2 dorsal fins. The first fin has a very small spine (Fig. 2) which represents 0.98% of the standard length (SL) and 7 other spines. The second fin is composed of 1 spine and 9 soft rays. The anal fin has 2 slender spines and 7 soft rays. Specimens have 5 to 7 in upper and 15 to 17 gillrakers in the lower part of the first arch. Their body is uniformly blackish-brown and paler ventrally. They have no spine on preopercular ridge.

Figure 2 illustrates the 21 metric characters measured in 20 captured specimens and the results are given in Table 1. Meristic data are presented in Table 2. Among the measured parameters, five were significantly correlated with standard or cephalic length: SL/TL, SL/FL, H/SL, T/SL, PV/SL.

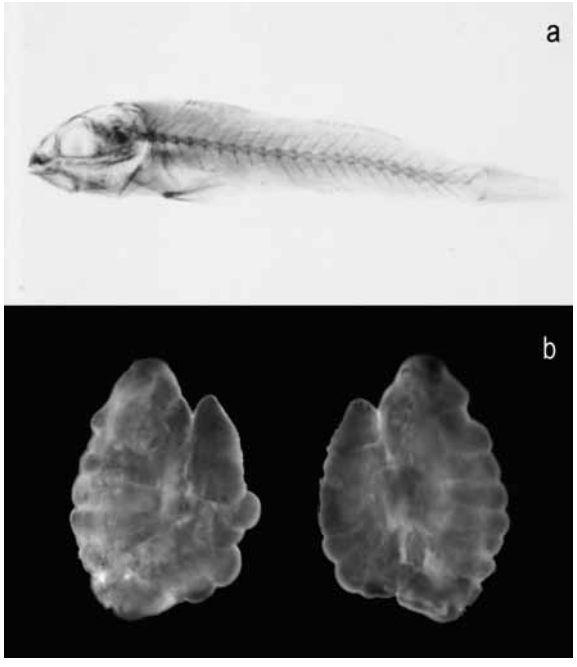

Fig. 3. Radiography (a) and otoliths (b) of a specimen of Synagrops japonicus (TL = 4.4 cm), caught in gulf of Annaba

Table 1. Relationships between metric characters measured for 20 specimens of Synagrops japonicus caught in the bay of Annaba. (The stars indicate the significance levels) SD: Standard deviation

Function	r	Mean% ±SD
SL / TL	0.79***	84.75 ± 3.84
SL / FL	0.79***	91.28 ± 4.68
PL / SL	0.36	18.44 ± 2.25
FLD / SL	-0.31	12.13 ± 1.61
SLD / SL	-0.05	13.93 ± 1.79
IDL / SL	-0.22	15.16 ± 2.46
LA / SL	0.05	11.46 ± 3.12
H / SL	0.53*	19.83 ± 1.31
T / SL	0.53*	10.29 ± 1.24
PA / SL	0.10	64.25 ± 3.57
PP / SL	0.40	30.11 ± 1.73
PV / SL	0.59**	31.15 ± 1.86
PD / SL	0.19	38.15 ± 2.98
CL / SL	0.40	26.88 ± 2.43
UL / CL	0.12	35.82 ± 4.54
O / CL	-0.22	26.05 ± 2.66
IO / CL	-0.07	29.60 ± 5.06
t / CL	-0.37	12.05 ± 2.76
h / CL	0.05	32.60 ± 5.50
FSH / SL	-0.44	0.97 ± 0.20

DISCUSSION

Synagrops japonicus is a benthopelagic species (MASUDA *et al.,* 1984), widely distributed throughout the Indian and Pacific oceans, between East Africa and Hawaii (FROESE & PAULY, 2014). The observed increase in the average temperature of water in the Mediterranean (BÉTHOUX *et al.,* 1990; FRANCOUR *et al.,* 1994; LAUBIER *et al.,* 2003; VARGAS-YANEZ *et al.,* 2005) could explain the current extent of its range. However, the autonomous arrival of this species on the coasts of Annaba seems unlikely, because it would be difficult to travel about 10,000 km without growing and without suffering the effects of predation. In addition, the depth of the Suez Canal (about 22 m) that the species should have crossed is incompatible with its bathymetric distribution (between 100 and 800 m) (FROESE & PAULY, 2014). Under these conditions, its presence could be explained by the increase and the efficiency of maritime transport (speed, reducing the distances traveled by canal effect). For example, over the last decade, the number of vessels docked at the port of Annaba increased by about 15% (from 619 to 912; source: Annaba Port Authority). Many of these are foreign ships that could have unintentionally carried alien species into Annaba bay. This would support the hypothesis of OCCHIPINTI-AMBROGI *et al.,* (2011) and QUIGNARD (2011) which states that the intrusion of adults of *S. japonicus* is due to ballast operations in sea waters.

The literature contains numerous references to shipping as a vector for long-distance trans-

Table 2. Meristic characteristics of Synagrops japonicus caught in gulf of Annaba

	Mode	Mean	SD	Limit values
Number of spines in the first dorsal fin	8	7.9	0.3	(7-8)
Number of spines in the second dorsal fin	1	-	-	-
Number of soft rays in the second dorsal fin	9	8.94	0.23	(8-9)
Number spines in anal fin	2	-	-	-
Number of soft rays in the anal fin	7	7.1	0.31	(7-8)
Number of soft rays in the pectoral fin	16	14.63	1.67	(10-16)
Number of lower gillrakers	16	16.1	0.73	(15-17)
Number of upper gillrakers	7	6.4	0.69	(5-7)

locations of fish in Mediterranean similar to the present case, and most authors have suggested that the animals have been transported in ballast water (MASTROTOTARO *et al.,* 2007; GOREN *et al.,* 2009). SCHEMBRI *et al.* (2010) describe four scenarios how fish may translocate through shipping from a far distant source port to a destination port. Only one of these possibilities may explain the presence of fry of *S. japonicus* in Annaba's bay: larvae enter the ship at the source port, continue developing during the journey and are discharged as advanced larvae or young juveniles at the destination port, then continue development in the wild. However, the observed presence of juveniles ($4 \leq TL \leq 4.8$ cm) at a specific time of year (June and July) for two consecutive years (2011 and 2012) leads us to hypothesize of successful reproduction of this species in the research area. However, a question arises: why have no bigger specimens been reported in the same region, despite a regular fishing effort, continuous scientific exploration and constant monitoring? This could be attributed to the fact that this fish live on the continental slope between 100 and 800 m depth (MASUDA *et al.,* 1984) and is difficult to catch. ORSI-RELINI (1990) captured a single specimen using commercial trawl fishing. On the coast of Annaba, the fishery is artisanal and is composed mainly of small crafts (75%) whose successful meeting with the relatively deep species is highly unlikely. An approach to support our hypothesis of a possible reproduction of *S. japonicus* in our region would be to accompany professional of offshore fishing boats, to ensure access to all deep water catches before sorting.

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Neobična pristunost juvenilnih primjeraka vrste *Synagrops japonicus* u jugozapadnom Mediteranu

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SAŽETAK

U ovom radu se navode dodatni nalazi vrste *Synagrops japonicus* (Doderlein, 1884) u zapadnom Mediteranu. Uhvaćeno je dvadeset juvenilnih primjeraka ove vrste u rasponu od 4 do 4,8 cm (TL) u Annaba zaljevu, Alžir, pomoću obalne mreže potegače, u ljeto 2011. godine (9 primjeraka, $4 \leq TL \leq 4{,}6$ cm) i 2012. (11 primjeraka, $4.2 \leq TL \leq 4{,}8$ cm). U radu su iznesene neke hipoteze o podrijetlu ove neobične prisutnosti.

Ključne riječi: *Synagrops japonicus*, novi nalaz, morfologija, Mediteran, Alžir