

ADDITIONAL RECORDS OF LESSEPSIAN TELEOST SPECIES OFF THE
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ABSTRACT

Investigations conducted off the northern Tunisian coast (central Mediterranean) allowed for the collection of specimens of three Lessepsian teleost migrants: the black-barred halfbeak *Hemiramphus far* (Forsskål, 1775), dusky spinefoot *Siganus luridus* (Rüppell, 1829) and marbled spinefoot *Siganus rivulatus* Forsskål, 1775. The species are described in this paper including morphometric measurements and meristic counts. These findings constitute the northernmost extension range for these species in the region, and their westernmost extension range in the Mediterranean Sea.

Key words: Osteichthyes, Hemiramphidae, Siganidae, Lessepsian migrant, Tunisian coast, Mediterranean

NUOVI AVVISTAMENTI DI TELEOSTEI LESSEPSIANI AL LARGO DELLA COSTA DELLA
TUNISIA (MEDITERRANEO CENTRALE)

SINTESI

Ricerche condotte nelle acque al largo della costa settentrionale della Tunisia (Mediterraneo centrale) hanno permesso di raccogliere esemplari di tre specie di teleostei migranti lessepsiani: pesce mezzobeco *Hemiramphus far* (Forsskål, 1775), pesce coniglio *Siganus luridus* (Rüppell, 1829) e siganide marmorizzato *Siganus rivulatus* Forsskål, 1775. Gli autori forniscono la descrizione delle specie, completa di misurazioni morfometriche e conte meristiche. Tali ritrovamenti rappresentano la segnalazione più settentrionale delle specie nella regione, e l'avvistamento più occidentale nel mare Mediterraneo.

Parole chiave: Osteichthyes, Hemiramphidae, Siganidae, migranti lessepsiani, costa della Tunisia, mare Mediterraneo

INTRODUCTION

Observations carried out over the last decades have shown the successful introductions of alien species, mainly as the result of the increasing temperature of the Mediterranean Sea (Francour *et al.*, 1994). These introductions induce competition between alien and native species, and consequently a strong modification of local biodiversity particularly affecting fish species (Ben Raïs Lasram & Mouillot, 2009).

Investigations conducted off the northern Tunisian coast from 2006 to 2012 resulted in the capture of 3 alien teleost species previously considered rare or unknown in the area: black-barred halfbeak *Hemiramphus far* (Forsskål, 1775), dusky spinefoot *Siganus luridus* (Rüppell, 1829) and marbled spinefoot *Siganus rivulatus* Forsskål, 1775. These captures suggest an extension range of these species in the area but also in the Mediterranean Sea (Fig. 1). In this paper we give a short description

of the 3 species and comment on both their local and Mediterranean distributions.

MATERIAL AND METHODS

All specimens were identified following identification keys and field guides such as Whitehead *et al.* (1984–1986) and Golani *et al.* (2002), then photographed, measured to the nearest millimetre and weighed for total mass, whereas liver and gonads were weighed to the nearest decigram. Stomach contents were removed and identified to the lowest possible taxon.

RESULTS AND DISCUSSION

Black-barred halfbeak *Hemiramphus far* (Forsskål, 1775)

Hemiramphus far is widely distributed in the Indo-Pacific and east Africa to the Philippines and Samoa (Collette & Parin 1986; Golani *et al.*, 2002). The species is rather abundant in the Red Sea and entered the Mediterranean Sea through the Suez Canal where it was first recorded in Palestine as *H. marginatus* by Steinitz (1927). Further records were from Syria (Gravel, 1929), Rhodes (Tortonese, 1937), Albania (see Collette & Parin, 1986), Egypt (El-Sayed, 1994), Libya (Shakman & Kinzelbach, 2007) and the Aegean Sea, off the coast of Turkey (Akça & Bilecenoglu, 2010)

H. far was reported for the first time in Tunisian waters by Charfi-Cheikhrouha (2004) off Raf-Raf, a city located in the northern region of the Gulf of Tunis. The second recording of this species is described in this paper (Fig. 2A). The specimen was captured on 1st December, 2010, with a gill-net having a mesh size of 24 mm at a depth of 3–4 m, together with labrid and sparid species on a rocky coralligenous bottom partially covered with algae and sea grass. The capture occurred off Ras Jebel, a city very close to Raf-Raf, approximately 5 km north, located at 37°14'34.56" N and 10°07'48.20" E.

The specimen was identified as follows: body elongated and laterally compressed, oval in cross-section. Upper jaw short, triangular and naked, without scales. Lower jaw greatly prolonged, beak-like. Dorsal and anal fins posterior in position. Anal fin below middle of dorsal fin lobe. Pectoral fin short. Pre-orbital ridge absent. Caudal fin deeply forked, lower lobe larger than upper lobe. Back grey bluish, with a series of six hardly visible black spots. Belly silvery white. Upper caudal fin yellow. The specimen was preserved in 10 % buffered formaline and deposited in the Ichthyological Collection of the Faculté des Sciences de Bizerte, with the catalogue number FSB-Hem-far-01.

Morphological description, colour, morphometric measurements with percentages of standard length (% SL) and meristic counts (Tab. 1) are in agreement with Collette & Parin (1986), Golani *et al.* (2002) and Akça &

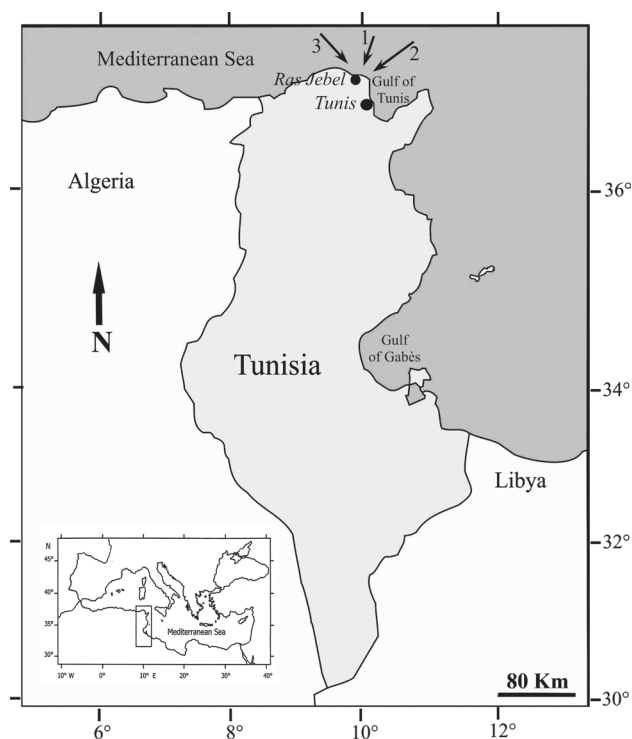


Fig. 1: Map of the Mediterranean showing Tunisia and map of the coast of Tunisia with arrows pointing out the capture site of: 1) Black-barred halfbeak *Hemiramphus far* (Forsskål, 1775); 2) Dusky spinefoot *Siganus luridus* (Rüppell, 1829); 3) Marbled spinefoot *Siganus rivulatus* Forsskål, 1775.

Sl. 1: Zemljevid Sredozemlja s Tunizijo in zemljevid tunizijske obale s puščicami, usmerjenimi proti lokacijam ulova: 1) vrste *Hemiramphus far* (Forsskål, 1775); 2) temnega morskega kunca *Siganus luridus* (Rüppell, 1829); 3) morskega kunca vrste *Siganus rivulatus* Forsskål, 1775.

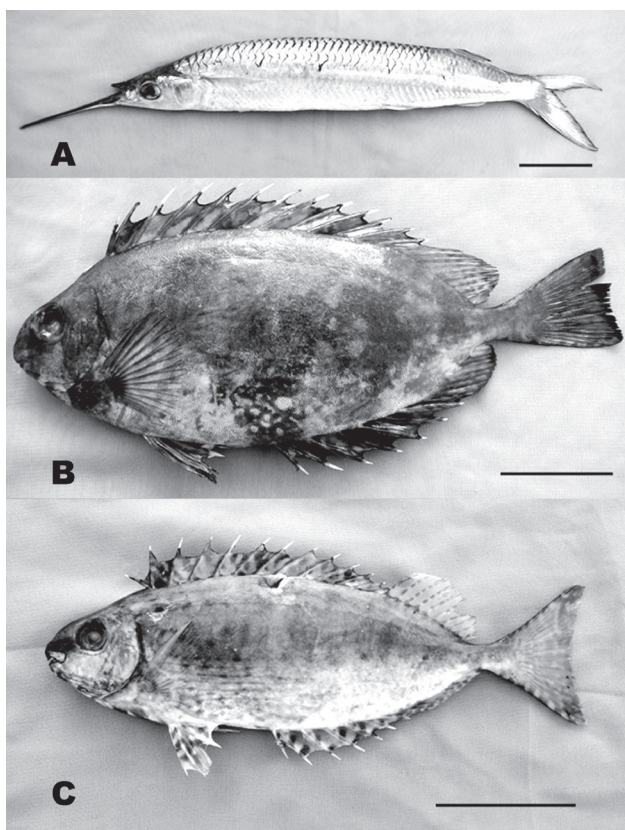


Fig. 2: A) *Black-barred halfbeak* *H. far*, scale bar = 20mm; B) *Dusky spinefoot* *S. luridus*, scale bar = 30mm; C) *Marbled spinefoot* *S. rivulatus*, scale bar = 50mm.
Sl. 2: A) *vrsta* *H. far*, *merilna enota* = 20 mm. B) *temni morski kunec* *S. luridus*, *merilna enota* = 30 mm; C) *morski kunec vrste* *S. rivulatus*, *merilna enota* = 50 mm.

Bilecenoglu (2010). The gut of the specimen contained undeterminable remains of food. The ovary was externally granulous and contained pre-vitellogenic oocytes. This female was probably a pre-spawning specimen.

Dusky spinefoot *Siganus luridus* (Rüppell, 1829)

Siganus luridus is widely distributed off the eastern African coast, off Réunion Island and in the Arabian Gulf (see Golani et al., 2002). The species has been entering the Mediterranean Sea through the Suez Canal since 1955 (Ben-Tuvia, 1964) and is at present successfully established in the eastern Mediterranean Basin; its reproductive biology, food and feeding habits have been studied (Bariche et al., 2003; Bariche, 2006). *S. luridus* migrated westward and is known to date in the Adriatic (Poloniato et al., 2010), central Mediterranean (Azzurro & Andaloro, 2004) and southern Mediterranean (Shakman & Kinzelbach, 2007).

S. luridus was first recorded in Tunisian waters by Ktari-Chakroun & Bouhlal (1971), in the Gulf of Tunis (northern Tunisia) and southward in the Gulf of Gabès

by Ktari & Ktari (1974). Additionally, Charfi-Cheikhrouha (2004) recorded a specimen captured off Raf-Raf, in 2002. The specimen described in this paper (Fig. 2B), was captured on 27th November, 2010, with a gill-net having a mesh size of 30 mm, at a depth of 5–6 m, on a rocky coralligenous bottom entirely covered with algae, together with several specimens of salemas *Sarpa salpa* (Linnaeus 1758). The capture occurred off Ras Jebel, located at 37°13'05.46" N and 10°11'26.52" E (Fig. 1).

The specimen was identified as follows: body deep, ellipsoid, compressed. Dorsal fin origin above pectoral fin base. Caudal fin truncated. Head slightly truncate with blunt snout. Mouth small with distinct lips. Longest dorsal spine longer than distance from the front of the eye to posterior edge of the opercle. Small scales embedded in skin. Colour brown to olive green with a touch of yellow on fins. The specimen was preserved in 10% buffered formaline and deposited in the Ichthyological Collection of the Faculté des Sciences de Bizerte, with the catalogue number FSB-Sig-lur-01.

Morphological description, colour, morphometric measurements and meristic counts (Tab. 1) are in agreement with Ben-Tuvia (1986), Golani et al. (2002) and Akça & Bilecenoglu (2010). The gut contained unidentified algae, confirming that *S. luridus* is an herbivore species (Bariche, 2006), the concomitant capture of several salemas, other herbivore species, suggests that they occupy the same ecological niche, so an interspecific competition pressure for food between both species cannot be totally excluded. The ovary was inconspicuous and surrounded by thick adipose tissue, the specimen was probably an adult female, size at first maturing occurring between 120 and 160 mm total length following Bariche et al. (2003).

Marbled spinefoot *Siganus rivulatus* Forsskål, 1775

The species is known in the Gulf of Aden and the Red Sea (Golani et al., 2002) and entered from the latter through the Suez Canal into the Mediterranean Sea where it was first recorded by Steinitz (1927) and at present it is successfully established especially in the eastern basin and the Aegean Sea (Bilecenoglu & Kaya, 2002). Additionally, the species acquired high economic importance in these areas (Papaconstantinou, 1990). The species is also known in the central and southern Mediterranean (Tortonese, 1978; Shakman & Kinzelbach, 2007).

S. rivulatus was observed for the first time by Ktari & Ktari (1974), and probably caught in the Gulf of Gabès (Bradaï et al., 2004). Further, two other captures were reported in the same area between May 1995 and October 2001 (Bradaï et al., 2004). The specimen presented in this paper was speared by a diver (Fig. 2C), on 30th March, 2011, at a depth of 5–6 m, on a rocky coralligenous bottom entirely covered with algae; it was surrounded by several specimens of salemas and common two-banded sea bream *Diplodus vulgaris* (E. Geoffroy

Tab. 1: Morphometric measurements in mm and as % standard length (SL), meristic counts and masses recorded in black-barred halfbeak *H. far* (FSB-Him-far-01), dusky spinefoot *S. luridus* (FSB-Sig-lur-01) and marbled spinefoot *S. rivulatus* (FSB-Sig-riv-01).

Tab. 1: Morfometrične meritve v mm in v % glede na standardno dolžino (SL), meristična štetja in teža, izmerjeni pri vrsti *H. far* (FSB-Him-far-01), temnem morskem kuncu *S. luridus* (FSB-Sig-lur-01) in morskem kuncu vrste *S. rivulatus* (FSB-Sig-riv-01).

Characteristic	FSB-Him-far-01		FSB-Sig-lur-01		FSB-Sig-riv-01	
	Pre-spawning female		Adult female		Pre-spawning female	
Morphometric measurements	mm	% SL	mm	% SL	mm	% SL
Total length	365	115.8	203	118.02	193	119.1
Standard length	315	100	172	100	162	100
Fork length	329	104.4	200	116.2	181	111.7
Pre-dorsal fin length	254	80.6	34	19.7	38.4	23.7
Pre-pectoral fin length	122.9	39.01	36.5	21.2	35.3	21.7
Pre-anal fin length	268	85.07	87	50.5	80.4	49.6
Longitudinal eye diameter	13.5	4.2	11.5	6.6	11.1	6.8
Vertical eye diameter	13.5	4.2	11.5	6.6	9	5.5
Dorsal fin length	31.7	10.06	119.4	69.4	111	68.5
Pectoral fin length	11.4	3.6	12.1	7.03	9.4	5.8
Anal fin length	19.2	6.09	72.6	42.2	68.4	42.2
Pelvic fin length	5.3	1.6	4.6	2.67	6.2	3.8
Caudal fin length	17.1	5.4	16.6	9.6	13.2	8.1
Body height	28.4	9.01	24.1	14.01	17	10.4
Pre-orbitary length	82.6	26.2	13.5	7.8	14.1	8.7
Post-orbitary length	23.7	7.5	12.7	7.3	14	8.6
Head length	118.7	37.6	37	21.5	38	23.4
Inter-orbitary length	15.2	4.8	12	6.9	11.7	7.2
Upper jaw	12.2	3.8	-	-	-	-
Lower jaw	74.1	23.5	-	-	-	-
Meristic counts						
Dorsal fin rays	12		XIV + 11		XIV + 10	
Pectoral fin rays	13		16		15	
Anal fin rays	11		VII + 10		VII + 9	
Caudal fin rays	24		19		18	
Pelvic fin rays	6		II + 3		II + 3	
Weight (dg)						
Total body	143.2		129.1		64.9	
Eviscerated body	137.9		110.8			55.4
Liver	1.8		1			0.8
Gonad	0.4		0.1			0.1
Stomach content	1.3		5.9			0.9

Saint-Hilaire, 1817). The capture occurred off Ras Jebel, located at 37°15'48.53" N and 10°04'27.65" E (Fig. 1).

The specimen was identified as follows: body oval and compressed caudal fin forked. Head moderately

concave with blunt snout. Mouth small with distinct lips, the upper thicker and slightly overhanging. Longest dorsal spine shorter than distance from front of the eye to the posterior edge of the opercle. Small embedded

scales. Colour of body grey-green to brown, with yellow-gold lines on flanks. Belly light-brown to yellow. The specimen is preserved in 10% buffered formaline and deposited in the Ichthyological Collection of the Faculté des Sciences de Bizerte, with the catalogue number FSB-Sig-riv-01.

Morphological description, colour, morphometric measurements and meristic counts (Tab. 1) are in agreement with Ben-Tuvia (1986), Golani *et al.* (2002) and Dulčić & Pallaoro (2004). The gut contained unidentified algae, confirming that like *S. luridus*, *S. rivulatus* is an herbivore species, Barriche (2006) noted that an interspecific competition pressure for food between both species cannot be totally excluded. The ovary was externally granulous and contained pre-vitellogenic oocytes. This female was probably a pre-spawning specimen.

Lessepsian migrations off the Tunisian coast

The recent captures of *H. far*, *S. luridus* and *S. rivulatus* confirm that these Lessepsian species could be successfully established in the new area, at least for the both siganid species, already recorded four decades ago. However, the occurrence of *H. far* is rather recent locally, and two records are not sufficient to definitively state that the population is established, such as is the case for other Mediterranean regions (Golani *et al.*, 2002). The records of the three species off Ras Jebel constitute their

northernmost extension range off the Tunisian coast, and their westernmost extension range in the Mediterranean Sea. Additionally, these few records from the northern Tunisian coast were probably due to the fact that the area is characterized by relatively colder and less saline waters (Lubet & Azzouz, 1969), than in southern areas such as the Gulf of Gabès (Ben Othman, 1971).

The Tunisian coast is located in the central Mediterranean, constituting a transitional area between the western and eastern basins; Bradaï *et al.* (2004) reported the occurrence of 14 alien species in the Tunisian waters, 8 from the Red Sea and 6 from the eastern Atlantic. Additionally, 9 other alien species were further recorded in the area (Ben Souissi *et al.*, 2005a, b, 2006a, b, 2011a, b; Ben Amor *et al.*, 2008, Azzouz *et al.*, 2011; Mansour *et al.*, 2011). At present, 4 allochthonous species are successfully established in Tunisian waters, an Atlantic migrant, blunthead puffer *Sphoeroides pachygaster* (Müller & Troschel, 1848) (Chérif *et al.*, 2010), and 3 lessepsian migrants Por's goatfish *Upeneus pori* Ben-Tuvia & Golani, 1989 (Ben Souissi *et al.*, 2005a; Azzouz *et al.*, 2010), filefish *Stephanolepis diaspros* Fraser-Brünner, 1940 (Ben Amor & Capapé, 2008), and bluespotted cornetfish *Fistularia commersonii* (Rüppel, 1835) (Rafrafi-Nouira *et al.*, 2011). Additionally, *S. luridus* and *S. rivulatus* should be included among the non-native species which successfully develop and reproduce in their new area.

DODATNI ZAPISI O POJAVLJANJU LESEPSKIH RIB KOSTNIC PRED TUNIZIJSKO OBALO
(OSREDNJE SREDOZEMLJE)

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POVZETEK

Med raziskavami pred severno tunizijsko obalo (v osrednjem Sredozemlju) so bili ulovljeni primerki treh lesepskih selivk: vrsta *Hemiramphus far* (Forsskål, 1775), temni morski kunec *Siganus luridus* (Rüppell, 1829) in morski kunec vrste *Siganus rivulatus* Forsskål, 1775. Primerki so podrobneje opisani v pričujočem članku, v katerem so navedeni tudi rezultati morfometričnih meritev in merističnih štetij. Ugotovitve pričajo tudi o širjenju njihovega areala v regiji proti severu in v celotnem Sredozemskem morju proti zahodu.

Ključne besede: ribe kostnice, Hemiramphidae, Siganidae, lesepska selivka, tunizijska obala, Sredozemlje

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