

# Westernmost occurrence of the dusky spinefoot *Siganus luridus* (Osteichthyes, Siganidae) along North African coasts

K. Ounifi–Ben Amor, S. Rafrafi–Nouira,  
O. El Kamel–Moutalibi & M. M. Ben Amor

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## Abstract

*Westernmost occurrence of the dusky spinefoot, Siganus luridus (Osteichthyes, Siganidae) along North African coasts.*— A specimen of dusky spinefoot *Siganus luridus* (Rüppel, 1829) was recorded in the peri–Mediterranean lagoon of Bizerte in northern Tunisia. This record constitutes the northernmost range of the species in Tunisian waters and the westernmost range on North African coasts. *Siganus luridus* is the second record known to date of a teleost Lessepsian species in a restricted brackish area. We describe the specimen, include morphometric measurements and meristic counts, and discuss the distribution of this herbivorous species in the Lagoon of Bizerte, in Tunisian waters and in the Mediterranean Sea.

Key words: Brackish lagoon, Expansion, Lessepsian species, Lagoon of Bizerte, Tunisia

## Resumen

*Presencia más occidental del sigano nebuloso, Siganus luridus (Osteichthyes, Siganidae) en las costas del norte de África.*— Un espécimen de sigano nebuloso *Siganus luridus* (Rüppel, 1829) fue registrado en la albufera de Bizerta, al norte de Túnez. Este registro constituye la localización más septentrional de la especie en aguas de Túnez y la más occidental en las costas del norte de África. *Siganus luridus* es el segundo registro conocido hasta la fecha de una especie de teleosteo lessepsiana en un área confinada de agua salobre. Describimos el espécimen incluyendo mediciones morfométricas y recuentos merísticos y discutimos la distribución de esta especie herbívora en la albufera de Bizerta, en aguas de Túnez y en el mar Mediterráneo.

Palabras clave: Laguna litoral de agua salobre (albufera), Expansión, Especies lessepsianas, Albufera de Bizerta, Túnez

## Resum

*Presència més occidental de Siganus luridus (Osteichthyes, Siganidae) a les costes del nord d'Àfrica.*— Un espécimen de *Siganus luridus* (Rüppel, 1829) va ser registrat a l'albufera de Bizerta, al nord de Tunísia. Aquest registre constitueix la localització més septentrional de

l'espècie en aigües de Tunísia i la més occidental a les costes del nord d'Àfrica. *Siganus luridus* és el segon registre conegut fins ara d'una espècie de teleosti lessepsiana en una àrea confinada d'aigua salabrosa. Describem l'espècimen incloent-hi mesures morfomètriques i recomptes merístics i discutim la distribució d'aquesta espècie herbívora a l'albufera de Bizerta, en aigües de Tunísia i al mar Mediterrani.

Paraules clau: Llacuna litoral d'aigua salabrosa (albufera), Expansió, Espècies lessepsianes, Albufera de Bizerta, Tunísia

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*Khadija Ounifi–Ben Amor & Mohamed Mourad Ben Amor, Laboratoire de Biodiversité, Biotechnologies et Changements climatiques, Faculté des Sciences de Tunis, Université Tunis El Manar. Tunis, Tunisia.– Sihem Rafrafi–Nouira & Olfa El Kamel–Moutalibi, Laboratoire d'Hydrobiologie Littorale et Limnique, Université de Carthage, Faculté des Sciences, Zarzouna, 7021 Bizerte, Tunisia.*

Corresponding author: Mohamed Mourad Ben Amor. E–mail: [benamor7@yahoo.fr](mailto:benamor7@yahoo.fr)

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## Introduction

Dusky spinefoot *Siganus luridus* (Rüppel, 1829) is a Lessepsian species (Por, 1978) distributed throughout the eastern African coast and around Reunion Island. It is known from the Arabian Gulf and the Red Sea (Golani et al., 2002). The species first entered the Mediterranean Sea through the Suez Canal in 1955 (Ben–Tuvia, 1964) and is currently successfully established in eastern areas of the Mediterranean (Bariche et al., 2003; Bariche, 2006), in Italian Waters–Islands of Linosa and Malta (Azzurro & Andaloro, 2004; Azzurro et al., in press; Schembri et al., 2012). To date, *S. luridus* has been recorded along the coasts of Levantine (Golani, 2010), Libya (Stirn, 1970; Lamboeuf, 2000), Northern Tunisia (Ktari–Chakroun & Bouhlal, 1971; Charfi–Cheikhrouha, 2004; Rafrafi–Nouira et al., 2012), Southern Tunisia in the Gulf of Gabès (Ktari & Ktari, 1974; Bradai, 2000), Cape d'Orlando, Northern Sicily (Castrìota & Andaloro, 2008), the French Mediterranean (Daniel et al., 2009), in the Gulf of Trieste —Northern Adriatic Sea— (Poloniato et al., 2010) and in Greek and Turkish waters (Bilecenoglu, 2010; Corsini–Foka et al., 2010). Research conducted in the area has reported that a specimen of *S. luridus* was captured in the Lagoon of Bizerte, a peri–Mediterranean brackish area (Quignard & Zaouali, 1980) located in northern Tunisia. In this paper, we provide a short description of the local specimen of *S. luridus*, and discuss the uncommon capture of the species in such a restricted area.

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## Material and methods

On 24 November 2015, a single specimen of *S. luridus* was captured in a gill–net with a mesh size of 30 mm, at 37° 19' 79" N and 9° 85' 66" E (figs. 1, 2) and at a depth of 12 m approximately on a soft bottom, partially covered with sea–meadows and algae. The specimen was identified following keys and field guides such as (Ben–Tuvia, 1986), and Golani et al. (2013). Morphological description, colour, morphometric measurements and meristic counts are in total accordance with Ben–Tuvia (1986), Rafrafi–Nouira et al.

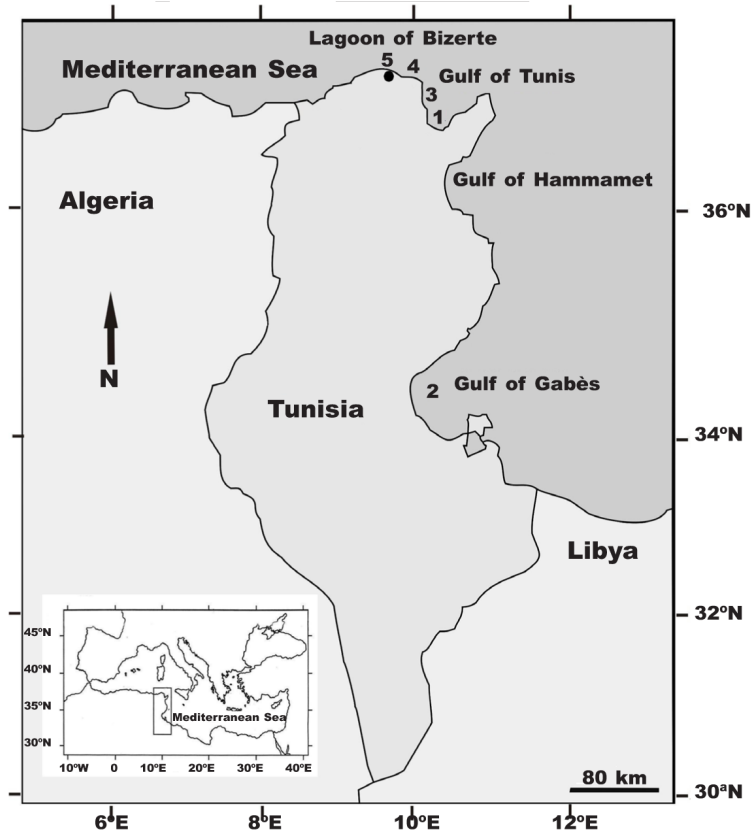


Fig. 1. Map of the Mediterranean Sea showing Tunisia (insert). Map of Tunisia showing capture sites of *Siganus luridus*: 1. Northern Tunisia, Gulf of Tunis (Ktari–Chakroun & Bouhlal, 1971); 2. Southern Tunisia, Gulf of Gabès (Ktari & Ktari, 1974; Bradaï, 2000); 3. Northern Tunisia, off Raf–Raf (Charfi–Cheikhrouha, 2004); 4. Northern Tunisia, off Ras–Jebel (Rafrafi–Nouira et al., 2012). 5. Northern Tunisia, Lagoon of Bizerte (this study).

Fig. 1. Mapa del mar Mediterràneo en el que apareix Túnez (recuadro). Mapa de Túnez en el que se indiquen els punts de captura de *Siganus luridus*: 1. Nord de Túnez, golfo de Túnez (Ktari–Chakroun & Bouhlal, 1971); 2. Sud de Túnez, golfo de Gabès (Ktari & Ktari, 1974; Bradaï, 2000); 3. Nord de Túnez, davant de Raf–Raf (Charfi–Cheikhrouha, 2004); 4. Nord de Túnez, davant de Ras–Jebel (Rafrafi–Nouira et al., 2012); 5. Nord de Túnez, albufera de Bizerta (este estudi).

(2012) and Golani et al. (2013) (table 1). The specimen was preserved in 10% buffered formalin and deposited in the Ichthyological Collection of the Faculté des Sciences de Tunis, receiving the catalogue number FST–Sig–lur–01 (fig. 3).

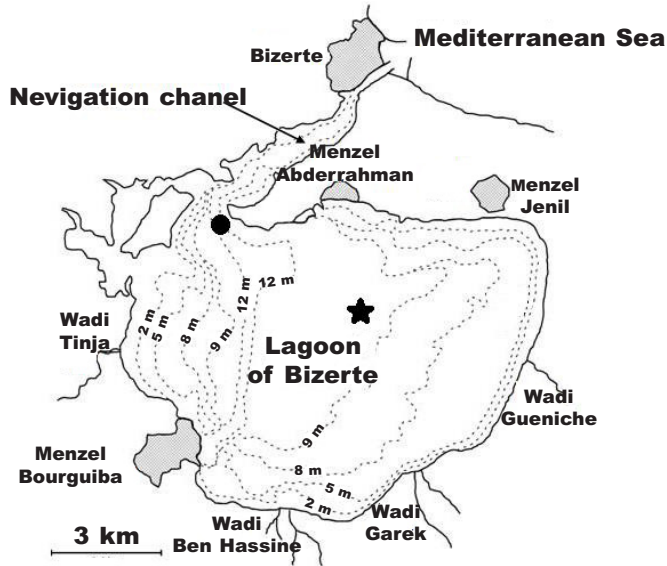


Fig. 2. Map of the Lagoon of Bizerte, showing capture sites of *Stephanolepis diaspros* (black circle, see Bdoui et al., 2004), and *Siganus luridus* (black star, this study).

Fig. 2. Mapa de la albufera de Bizerta en el que se indiquen los puntos de captura de *Stephanolepis diaspros* (círculo negro, ver Bdoui et al., 2004) y *Siganus luridus* (estrella negra, este estudio).

## Results and discussion

The specimen of *S. luridus* specimen described here measured 197 mm total length and weighed 112.5 g. It was identified by the following combination of characters: body slightly compressed, dorsal fin origin above pectoral fin base, caudal fin truncated, head slightly truncated with blunt snout, mouth small with distinct lips, small scales embedded in skin, and colour brown to olive green with yellow notches on fins.

*S. luridus* is one of the first Lessepsian migrants in the Mediterranean Sea (Ben–Tuvia, 1964); it progressively invaded southern and eastern areas where it is of local commercial interest (Shakman et al., 2008). This pattern explains why the species is more commonly caught in Tunisian southern areas, such as the Gulf of Gabès where Bradai (2000) reported several captures of mature specimens. The species recently expanded its distribution towards northern Tunisia (Charfi–Cheikhrouha, 2004; Rafrafi–Nouira et al., 2012). This present capture confirms the northernmost range of the species in Tunisian waters (about 475 km), reaching islands such as Linosa, Malta and Lampedusa in the strait of Sicily (Azzurro et al., in press) and constituting the westernmost finding in the North African coasts to date. This expansion is probably due to the global warming of the Mediterranean Sea (Francour et al., 1994), including the Tunisian waters, and explains captures of other species previously unknown in northern areas (Rafrafi–Nouira et al., 2015). This present capture also indicates that a sustainable population of *S. luridus* is at present probably established in Tunisian waters (Zenetos et al., 2012; Ounifi–Ben Amor et al., 2016).

Table 1. Morphometric measurements (in mm and as % standard length, %SL) and meristic characters recorded in an adult female of dusky spinefoot *Siganus luridus* (FST–Sig–lur–01).

Tabla 1. Medidas morfológicas (en mm y en % longitud estándar, %LE) y recuentos merísticos registrados en una hembra adulta de sigano nebuloso *Siganus luridus* (FST–Sig–lur–01).

Morphometric measurements	mm	%SL
Total length	197	118.7
Standard length	166	100
Fork length	189	113.9
Pre–dorsal fin length	35.5	21.4
Pre–pectoral fin length	36	21.7
Pre–anal fin length	82	49.4
Longitudinal eye diameter	11.2	6.7
Vertical eye diameter	10.5	6.3
Dorsal fin length	116	69.9
Pectoral fin length	11.6	7
Anal fin length	70.5	42.5
Pelvic fin length	4.5	2.7
Caudal fin length	16.9	10.2
Body height	22	13.3
Pre–orbital length	13.2	8
Post–orbital length	12.8	7.7
Head length	36	21.7
Inter–orbital length	11.5	6.9
<b>Meristic counts</b>		
Dorsal fin rays	XIV + 11	
Pectoral fin rays	15	
Anal fin rays	VII + 9	
Caudal fin rays	19	
Pelvic fin rays	II + 3	

This capture of *S. luridus* is also the first known record to date of the species in a peri-Mediterranean lagoon, even though other fish species have previously been reported from Tunisian brackish areas (Capapé et al., 2004; Mejri et al., 2004; Ben Souissi et al., 2005; El Kamel et al., 2009). Nevertheless, captures of alien species are very rare in these areas. Two captures have been reported to date in the Lagoon of Bizerte, a reticulated leather-jack *Stephanolepis diaspros* (Fraser–Brünner, 1940) reported by Bdioui et al. (2004) and a Por's goatfish *Upeneus pori* (Ben–Tuvia & Golani, 1989) reported by Azzouz et al. (2010). These captures are mainly considered to be consequence of environmental changes (Ben Rais Lasram & Mouillot, 2009), but also thought to appear as the result of the favourable biological features of the Lagoon of Bizerte, where sea–meadows and algae covering rocky

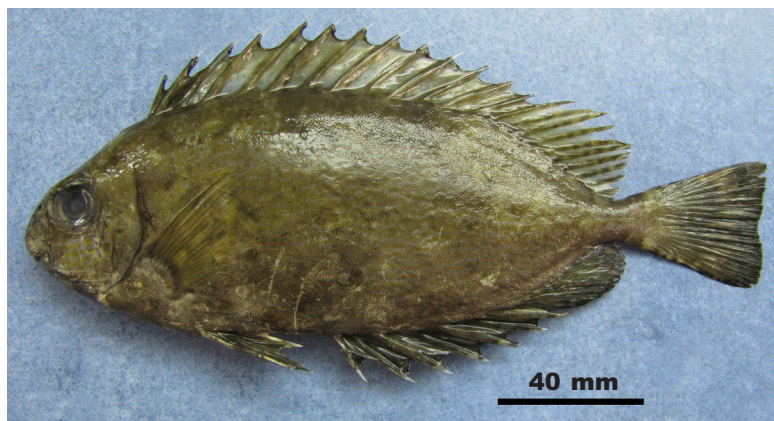


Fig. 3. Specimen of *Siganus luridus* (FST–Sig–lur–01) captured in the Lagoon of Bizerte.  
Fig. 3. *Espècimen de Siganus luridus* (FST–Sig–lur–01) capturatado en la albufera de Bizerta.

bottoms are very abundant (Aïssa, 1991). Therefore, prey availability plays an important role in the occurrence of alien species in the Lagoon of Bizerte, and the captures reported herein could be considered good examples.

*S. luridus* is an euryphagous herbivore that grazes on algae; it is selective when sea-grass and algae are abundant but consumes whatever is available during the unfavourable season (Lundberg & Golani, 1995). This explains why it is dominant in some Mediterranean areas where it does not compete for food with other species, particularly carnivores (Bariche et al., 2004). *Siganus luridus*, a thermophilic, highly invasive species, has the potential to deplete entire algal beds (Sala et al., 2011). The success of the expansion of some Lessepsian species is due to their high eco-physiological plasticity (Ben Rais Lasram et al., 2008; Marras et al., 2015). *S. luridus* has adapted its diet in all its new environmental conditions, becoming potentially dangerous for indigenous species (Stergiou, 1988). It is therefore necessary to carefully check for invasive species such as siganids because they have a negative impact on local ichthyofauna in the Lagoon of Bizerte, an area which is already confronted with pollutant factors that also contribute to the decline of some animal populations (Harzallah, 2003).

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