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FIRST RECORD OF THE DUSKY SPINEFOOT *SIGANUS LURIDUS* (RÜPPELL, 1828) IN THE ADRIATIC SEA

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ABSTRACT

*During regular monitoring of the marine protected area of Miramare (Gulf of Trieste, northern Adriatic Sea) in August and September 2010, a specimen of the dusky spinefoot *Siganus luridus* (Rüppell, 1828) was sighted, photographed and filmed. This is the first record of this Lessepsian migrant in the Adriatic Sea. Although only a single specimen was observed in the studied area, this record represents a further spreading of an alien species which has already established its populations in different countries of the eastern and southern Mediterranean Sea.*

Key words: *Siganus luridus*, dusky spinefoot, alien species, Lessepsian migration, Adriatic Sea

PRIMA SEGNALAZIONE DEL PESCE CONIGLIO *SIGANUS LURIDUS* (RÜPPELL, 1828) IN MARE ADRIATICO

SINTESI

*Durante il regolare monitoraggio dell'Area Marina Protetta di Miramare (Golfo di Trieste, Adriatico settentrionale) nel periodo agosto-settembre 2010, un esemplare di pesce coniglio *Siganus luridus* (Rüppell, 1828) è stato avvistato, fotografato e filmato. Si tratta della prima segnalazione di questo migrante lessepsiano nel mare Adriatico. Benché un solo esemplare sia stato avvistato nell'area di studio, tale ritrovamento rappresenta un'ulteriore espansione dell'areale di distribuzione di una specie aliena, le cui popolazioni si sono già stabilite in diverse nazioni del Mediterraneo orientale e meridionale.*

Parole chiave: *Siganus luridus*, pesce coniglio, specie aliene, migranti lessepsiani, mare Adriatico

INTRODUCTION

During the last decade, the number of records of alien macroalgae and animal species in the Mediterranean Sea has been increasing very rapidly. According to Zenetos *et al.* (2008), at least 903 alien species have been introduced into the Mediterranean Sea. Since the opening of the Suez Canal in 1869, there has been an influx of Red Sea and Indo-Pacific organisms into the Mediterranean Sea, a phenomenon known as lessepsian migration (Por, 1978). During the past decades, 74 lessepsian fish species have been recorded from the Mediterranean Sea (Golani, 2010), while 11 were reported from the Adriatic Sea (Dragičević & Dulčić, 2010). Biodiversity changes in the Mediterranean Sea occur at an exceptional rate, bringing the rate of introductions to 1 species every 1.5 weeks (Zenetos, 2010).

In this paper, the first record of the lessepsian migrant the dusky spinefoot *Siganus luridus* (Rüppell, 1828) in the Adriatic Sea is presented. On the basis of observations, photographs and movies taken of a single specimen of the dusky spinefoot *S. luridus*, this species could be added to the Adriatic checklist of fishes presented by Lipej & Dulčić (2010).

MATERIAL AND METHODS

From 1992, regular monitoring of coastal fish fauna by means of visual census techniques has been conducted in the marine protected area (MPA) of Miramare (Gulf of Trieste). Since 2000, fish fauna monitoring has been performed at least once per week in the period

from May to September and at least twice per month in the period from October to April. Visual censuses are performed by skilled divers of the WWF Miramare.

During regular monitoring of costal fish assemblage in August and September 2010, a specimen of the dusky spinefoot *S. luridus* was sighted, photographed (Fig. 1) and filmed at the locality of Bagno Ducale in the MPA of Miramare (Fig. 2). It was firstly sighted on 17 and 19 August, afterwards it was photographed on 28 August, while the movie of this specimen was taken on 13 September. At that time, the weather changed severely and the specimen has not been sighted anymore. The specimen was swimming together with other native fish, mostly wrasses (family Labridae), in the rocky habitat type at the depth of 1 to 2 m. The area where the specimen was detected is a typical habitat of the photophilous algae biocoenosis (degraded stage of the association of *Cystoseiretum crinitae*).

The specimen was photographed with a digital camera Nikon D2x with 60 mm Micro Nikkor lens, Seacam housing and Sea&Sea YS-120 flash. The photographs were sent to Daniel Golani from the Hebrew University in Jerusalem (Israel), who confirmed the identification.

RESULTS AND DISCUSSION

On the basis of the set of digital photos, the specimen was identified as a member of the family Siganidae, according to its typical body shape and colour pattern. The species was determined due to the typical truncated caudal fin, which is forked in similar Lessepsian species



Fig. 1: Specimen of *Siganus luridus*, photographed at the locality of Bagno Ducale in the WWF Miramare Marine Protected Area, Trieste. (Photo: D. Poloniato)
Sl. 1: Primerek vrste *Siganus luridus*, fotografiran na lokaliteti Bagno Ducale znotraj zavarovanega območja WWF Miramare pri Trstu. (Foto: D. Poloniato)

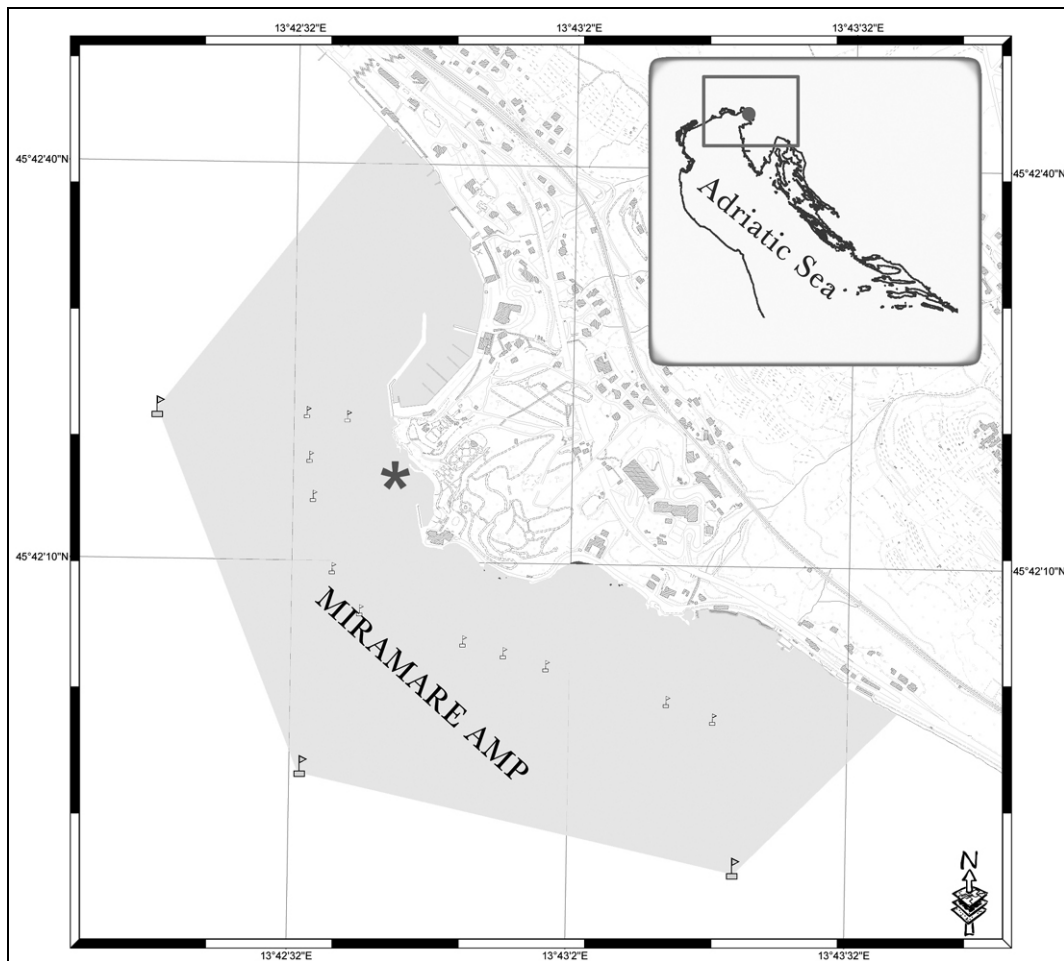


Fig. 2: Map of the studied area with the locality, where the specimen of *S. luridus* was sighted.
Sl. 2: Zemljevid obravnavanega območja z lokaliteto, kjer je bil opazovan primerek vrste *S. luridus*.

Siganus rivulatus. The most important diagnostic features are: body deep, ellipsoid, compressed; dorsal fin origin above pectoral fin base; dorsal ray portion margin round; caudal fin truncated; head slightly concave with blunt snout; mouth small with distinct lips; body dark brown to olive green with a touch of yellow on the fins.

In the past, photographs already served as reliable evidence for assessing the presence of certain rare or less known species (Dulčić *et al.*, 2006). Nowadays SCUBA diving equipment proved to be an optimal tool for assessing the ichthyofauna, especially in protected areas. This is especially true for certain cryptobenthic species, which are hard to be sampled with the classical destructive methods. Many rare or less known species such as *Millerigobius macrocephalus*, *Apletodon incognitus*, *Thorogobius ephippiatus* among others, were detected with SCUBA diving equipment for the very first time in the Gulf of Trieste (see Lipej *et al.*, 2005, 2007).

The first record of *S. luridus* in the Adriatic Sea represents a new species reported for the Adriatic ichthyofauna, which means that the total number of up to date

recorded marine fish species is 442 (see Lipej & Dulčić, 2010). With the inclusion of *S. luridus*, the number of confirmed Lessepsian migrants in the Adriatic Sea rises to 12. However, the great majority of them were recorded only at single occasions (Dulčić *et al.*, 2003). In the Gulf of Trieste, the dusky spinefoot is the third alien fish species recorded up to date. On 16 May 1998, a 12 cm long orange-spotted grouper *Epinephelus coioides* was caught near Trieste and delivered to the Aquarium in Trieste alive (Parenti & Bressi, 2001). Five years later the specimen measured 52 cm in total length. The second alien fish recorded in the studied area was *Terapon theraps*, which was caught in nets in waters off Piran on 10 August 2007 (Lipej *et al.*, 2008).

The dusky spinefoot is one of the first lessepsian migrants in the Mediterranean Sea, since it was first discovered in Israeli waters in 1955 (Ben-Tuvia, 1964). One siganid, the marbled spinefoot *S. rivulatus* has already been reported in the Adriatic Sea by Dulčić & Pallaoro (2004), while *S. luridus* has up to date been recorded along the Levantine coast (see for example Go-

lani, 2010), Libya (Štirn, 1970), Tunisia (Ktari Chakroun & Bouhlal, 1971), waters off Turkey and Greece (see for example Bilecenoglu, 2010 and Corsini-Foka, 2010), and Italian waters (Azzurro & Andaloro, 2004; Castriota & Andaloro, 2005; Orsi-Relini, 2010). It was recently confirmed also for the French Mediterranean coast (Daniel *et al.*, 2009). Nowadays, *S. luridus* together with its congeneric species *S. rivulatus* has a commercial importance in the eastern and central south Mediterranean Sea (Shakman *et al.*, 2008).

The dusky spinefoot is a herbivorous fish that feeds mainly on coarse brown algae, and thrives in rocky shallow habitats covered with vegetation (Golani *et al.*, 2002). It has become dominant in many eastern Mediterranean coastal areas, where it competes with the main native herbivores, *Sparisoma cretense* and *Sarpa salpa* (Bariche *et al.*, 2004) and has altered the community structure and the native food web along the Levantine rocky infralittoral zone (Galil, 2007). Together with *S. rivulatus*, it is considered to be a common commercial fish in the Levantine Sea (Streftaris & Zenetos, 2006), and invasive in other parts of the eastern Mediterranean Sea.

Up to date about a third of all Lessepsian species have succeeded in dispersing over the Mediterranean Sea (Ben Rais Lasram *et al.*, 2008). The success of Lessepsian migrant fish species in colonization of the eastern Mediterranean was often explained as the exploitation of unsaturated niches (Golani, 2010). *S. luridus* and its Lessepsian congener *S. rivulatus* are typical herbivores, which succeed to colonize new areas due to the scarcity of native herbivorous fish (Lundberg & Golani, 1995). In a narrower aspect, *S. luridus* is considered to be a euryphagous herbivore, grazing on different algal species without preference. Lundberg *et al.* (1999) reported that the two *Siganus* species are rather selective when macrophyte assemblages are diverse and abundant, and will consume whatever is available during the unfavourable season. Galil (2007) discussed the impact the siganids were having on the Mediterranean biota, pointing out the results of some studies, which demonstrated that siganids had significant impact on the local algal community, causing even eradication of certain algal species. Recently it was assessed that both siganids species represented more than a third of total fish biomass in the rocky habitats in Israeli Mediterranean waters (Goren & Galil, 2005).

Sightings of a single specimen of *S. luridus* in a single locality should at the moment be taken only as a sign of

an ordinary arrival of an alien species in the new environment of the Gulf of Trieste. At the very same time Por (1978) predicted that the expansion of Lessepsian immigrants in the Mediterranean Sea would be limited by minimum winter surface temperature lower than 16 °C. However, since the dusky spinefoot is known to be one of the so-called Lessepsian species with strong dispersal (*sensu* Ben Rais Lasram *et al.*, 2008), the success of the dusky spinefoot in the Mediterranean Sea was attributed to its large eco-physiological plasticity. This species has adapted its feeding regime to the new environmental conditions (Lundberg & Golani, 1995), showing high competitive potential to the detriment of indigenous species (Stergiou, 1988). Its spawning season has shortened, probably in relation to the varied seawater temperatures that are found in the Mediterranean Sea (Bariche *et al.*, 2003). Hassan *et al.* (2003) reported the absence of genetic differentiation between the Mediterranean Sea and the Red Sea populations, with exclusion of bottleneck events. These characteristics, together with the recent Adriatic and Mediterranean Sea warming, give us reason to suppose that *S. luridus* is a potential invader of the Adriatic Sea. The present record does not allow any confident comment to be made regarding whether or not the species has established a breeding population in the area. However, although only a single specimen was observed in the studied area, this record represents a further spreading of an alien species which has already established its populations in different countries of the eastern and southern Mediterranean Sea. A speculative reason for the spreading success of this species in the new environment is that it presumably occupied an unsaturated ecological niche with only scarce herbivorous indigenous fish species (Golani *et al.*, 2002). In any event, the impact of possible successful colonization by this and other exotic fish species would at least represent a change in the composition of the native ichthyofauna.

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PRVI ZAPIS O POJAVLJANJU TEMNEGA MORSKEGA KUNCA *SIGANUS LURIDUS* (RÜPPELL, 1828) V JADRANSKEM MORJU

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POVZETEK

Tekom rednega monitoringa ribjih združb v zavarovanem območju Miramare pri Trstu (Tržaški zaliv) v avgustu in septembru 2010 je bil opažen, fotografiran in s podvodno videokamero posnet primerek temnega morskega kunca *Siganus luridus* (Rüppell, 1828). Gre za prvo opazovanje te lesepske selivke v Jadranskem morju. Navzlic enemu samemu opaženemu primerku na obravnavanem območju ta zapis predstavlja nov dokaz o širjenju areala te vrste v Sredozemskem morju. V mnogih obmorskih državah vzhodnega in južnega dela Sredozemlja se je ta tujerodna vrsta že ustalila in ustvarila stabilne populacije.

Ključne besede: *Siganus luridus*, temni morski kunec, tujerodna vrsta, lesepska selitev, Jadransko morje

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