

First record of *Selene dorsalis* (Osteichthyes: Carangidae) in the Mediterranean Sea, from coastal waters off the Maltese Islands

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The first Mediterranean record of the African moonfish, *Selene dorsalis*, is reported, with the capture of a single female specimen by means of a trammel net from coastal waters off the Maltese Islands. The species is a non-indigenous one for the Mediterranean, being native of tropical and subtropical waters of the east Atlantic. The Mediterranean record of *S. dorsalis* could be indicative of a northward range expansion of the species, spurred in part by the recent warming trend observed in the Mediterranean Sea.

Keywords: *Selene dorsalis*, Mediterranean Sea, non-indigenous, range expansion

In August 2007, a female *Selene dorsalis* was caught at night by means of a traditional trammel net at a depth of 18 m on the Munxar Reef, in shallow waters off the south-eastern coast of the island of Malta, central Mediterranean (Figure 1). This is the first time this species has been recorded in the Mediterranean Sea, with its native range consisting of tropical and subtropical waters of the east Atlantic, from the Cape Verde Islands and Senegal to South Africa, and being generally a rare species in waters north of 18°N (Smith-Vaniz, 1986). The specimen was identified by T. Schembri, from the Department of Biology of the University of Malta, and different measurements were taken, following the FAO procedures (Agger et al., 1974).

Material examined

Selene dorsalis (Figure 2), 158.1 mm SL, Munxar Reef (Malta), 35°88'N–14°44'W, depth: 18 m, 12 August 2007.

Specimen Description

The specimen examined was a female weighing 110.6 g, with a total length of 212.5 mm. The distinctive characters were coincident with those given by Smith-Vaniz and Berry (1981) and are reported in Table 1.

The African moonfish individual exhibits two dorsal fins, as has been reported for specimens of the same species caught in the Gulf of Cadiz (Juarez et al., 2006) and in the Canary Islands (Castro-Hernández, 2001). The first dorsal fin has four spines preceded by three smaller ones (not very apparent) and separated from the fin. There are three other spines between the first and the second dorsal fins. The second dorsal fin presents one spine and 23 soft rays. Second dorsal fin lobe only slightly elongated, contained 9.8 times in fork length, which is consistent with the range given by Smith-Vaniz & Berry (1981), i.e. 7.2–10.1 times. Pelvic fin relatively short, becoming nearly rudimentary (2.7 times smaller than the upper jaw length). The anal fin has two reabsorbed spines, followed by one spine and 20 soft rays.

The body shape is short, deep (its depth being 1.93 times its fork length), extremely compressed and silvery with a light metallic bluish cast dorsally, a faint dusky opercular



Figure 1. Location of Munxar Reef (denoted by 'M.R.') in the Maltese Islands, site of collection of the *Selene dorsalis* specimen.



Figure 2. *Selene dorsalis* specimen caught in coastal waters off the Maltese Islands.

spot and a narrow black area on the top of the caudal peduncle. Head profile rounds at the top and slopes sharply through a slight concavity in front of the eye to a blunt snout with the lower jaw protruding. Eye moderately small, with head length 3.96 times its diameter, compared with the range of 3.3 to 4.2 given by Smith-Vaniz & Berry (1981). Upper jaw short, expanded at the posterior end, and ending far below and about under the anterior margin of the eye. Lower jaw had a narrow irregular band tapering to an irregular row posteriorly. Fins are clear, with olive-yellow tints on the second dorsal, anal, pectoral and caudal fin lobes. Pelvic fins are white.

Scales are small, cycloid and smooth to the touch and cover most of the lower half of the body but are absent anteriorly on most of the area from the pelvic fin base to the junction of curved and straight portions of lateral line. Scutes in the straight part of lateral line are weak, being too inconspicuous to count.

DISTRIBUTION AND DISCUSSION

Selene dorsalis is a demersal fish species, with young of less than 3 cm fork length occurring near the surface; juveniles may be found in bays and river mouths (Smith-Vaniz & Berry, 1981). The species generally forms schools, is carnivorous (feeding on small crustaceans and other fish) and is found within a depth range of 20–100m (Smith-Vaniz, 1986). The species is described as resilient, with a minimum population doubling time of less than 15 months (Smith-Vaniz, 1986). It is known by a series of different common names, including African moonfish, Atlantic moonfish, Guinean moonfish, African lookdown, shiner and pompano.

The African moonfish is a subtropical eastern Atlantic species which is common off the Cape Verde Islands and from Senegal to South Africa (Smith-Vaniz & Berry, 1981; Seret, 1990), being fished on a commercial basis by means of pelagic and bottom trawls, especially off Ghana (Smith-Vaniz & Berry, 1981). The species is replaced by *Selene setapinnis* in the western Atlantic (Froese & Pauly, 2008). Bianchi (1992) lists the species as one of the four most common ones within shallow water assemblages from Angola to Benguela. Despite being considered rare north of 18°N (Smith-Vaniz, 1986), the species has established itself in waters around Portugal and Madeira—in fact, the species was first recorded from such waters by Smith-Vaniz & Berry (1981), with its presence being recently confirmed by Wirtz et al. (2008).

Selene dorsalis is not listed amongst the ninety exotic fish species list in the CIESM Atlas of Exotic Species in the Mediterranean (Fishes; Golani et al., 2004), since the atlas includes exotic fish species for which at least three distinct published records exist. This may suggest that the *S. dorsalis* individual recorded in the central Mediterranean may simply constitute a vagrant (occasional adult visitor) or casual individual, rather than a member of a well-established population. The current record may be indicative of a ‘range expansion’ by the species, as postulated by Mori & Vacchi (2002), which may be the direct consequence of the well-documented warming of the Mediterranean Sea, rendering it more congenial to (sub) tropical species (Bianchi, 2007). Entry of *S. dorsalis* into the Mediterranean could have been mediated by the ship ballast water-transport of larvae or juveniles of the species, as this constitutes one of the major avenues of proliferation of non-indigenous species (Galil, 2006), besides through the unaided dispersal of adult specimens. The displacement of the northern limit of the native range of the species, due to local-warming of water masses, is also hinted at by Juarez & Silva, 2006, after successive records of *S. dorsalis* from the Canary Islands, Spain (Castro-Hernandez, 2001), Moroccan waters (Baddy & Guenette, 2001) and the Gulf of Cadiz, Spain (Juarez & Silva, 2006).

Within the Mediterranean, *S. dorsalis* could potentially be described as an ‘unestablished alien’ (defined by Occhipinti-Ambrogi & Galil, 2004, as ‘an alien lacking self-maintaining populations outside its natural range, either because it were unable so far to settle, or is too newly arrived’), since the new species record being reported in this paper is not supported, to date, by other similar records elsewhere in the Mediterranean. Alternatively, the individual recorded could constitute a casual Atlantic entry, although the progressive northward spread of the species, as recorded in literature, might suggest the ‘unestablished alien’ status as being more plausible. Comprehensive

Table 1. Morphometric and meristic data of the specimen of *Selene dorsalis* recorded in the Maltese Islands.

Parameter	Measure
Weight in g	110.6
Total length in mm	212.5
Fork length in mm	178.0
Standard length in mm	158.1
Dorsal extreme length in mm	211.8
Dorsal normal length in mm	209.4
Ventral normal length in mm	208.3
(Dorsal) body length in mm	165.9
Opercular head length in mm	49.7
Mandibular length in mm	21.0
Anterior dorsal fin base length in mm	6.1
Posterior dorsal fin base length in mm	72.1
Anal fin base length in mm	64.5
Preanterior dorsal distance in mm	57.2
Preposterior dorsal distance in mm	85.7
Prepectoral distance in mm	52.9
Preanal distance in mm	57.9
Preventral distance in mm	52.4
Perpendicular iris diameter in mm	12.1
Perpendicular pupil diameter in mm	5.2
Greatest body depth in mm	92.0
Perpendicular anal depth in mm	79.1
(Least) peduncle depth in mm	7.1
Ventral fin length in mm	7.7
Pectoral fin length in mm	67.3

ichthyological censuses are necessary to establish conclusively the current status of *S. dorsalis* in the Mediterranean Sea.

One third of the exotic fish species recorded in the Mediterranean listed by Golani et al. (2004) originate from Atlantic regions, most being from tropical, rather than boreal, regions of the Atlantic. In fact, just three of the ninety recognized (established) exotic fish species in the Mediterranean are of boreal origin (Golani et al., 2004). Of the exotic fish species of Atlantic affinity, just four have established populations in the Mediterranean basin, as testified by their being regularly caught. Conversely, according to the same authors, more than a dozen 'Lessepsian' fish migrants are of commercial importance in the Mediterranean, suggesting that the physico-chemical characteristics of the basin are more congenial to Indo-Pacific and Erythrean introductions.

To date, at least fourteen exotic fish species have been reported from coastal waters off the Maltese Islands and the broader (including waters around the Pelagian Islands and between Sicily and Tunisia) Malta Channel in the central Mediterranean (Sciberras & Schembri, 2008; Azzurro et al., 2008). Of these, just four (*Seriola* sp., *Seriola fasciata*, *Seriola carpenteri* and *Pisodonophis semicinctus*) have an Atlantic (tropical, in many cases) affinity.

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