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## The yellowfin surgeonfish *Acanthurus xanthopterus* Valenciennes, 1835 (Actinopterygii: Perciformes: Acanthuridae) from Mediterranean Egyptian waters

Mohammed ADEL<sup>1</sup>, Ola Mohamed NOUR<sup>2</sup>, Sara A. A. AL MABRUK<sup>3,4</sup>, Bruno ZAVA<sup>5,6</sup>, Alan DEIDUN<sup>7</sup> and Maria CORSINI-FOKA<sup>8</sup>

<sup>1</sup> Egyptian CMAS Spearfishing Committee, Alexandria, Egypt

<sup>2</sup> Department of Biology and Geology, Faculty of Education, Alexandria University, 21526 Alexandria, Egypt

<sup>3</sup> Department of General Nursing Technology, Higher institute of Science and Technology, Cyrene, Libya

<sup>4</sup> Marine Biology in Libya Society, El Bayda, Libya

<sup>5</sup> Museo Civico di Storia Naturale, via degli Studi 9, 97013 Comiso (RG), Italy

<sup>6</sup> Wilderness studi ambientali, via Cruillas 27, 90146 Palermo, Italy

<sup>7</sup> Department of Geosciences, University of Malta, Msida MSD 2080, Malta

<sup>8</sup> Hellenic Centre for Marine Research, Institute of Oceanography, Hydrobiological Station of Rhodes. Cos Street, 85100 Rhodes, Greece

Correspondent author: Maria Corsini-Foka; [mcorsini@hcmr.gr](mailto:mcorsini@hcmr.gr)

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### Abstract

An adult of *Acanthurus xanthopterus* Valenciennes, 1835 was caught in the waters off Alexandria, Egypt, in August 2021, through spearfishing. This finding documents the first occurrence of the species in the Mediterranean basin. Description of the specimen, morphometric measurements and meristic characters are given. The yellowfin surgeonfish is widely distributed in the Indo-Pacific region, absent in the Red Sea and is a popular aquarium fish. Potential routes of introduction of the species into the Mediterranean are briefly discussed.

**Keywords:** Non-Indigenous Species; Acanthuridae; Surgeonfish; eastern Mediterranean Sea; Egypt; aquarium fish; citizen science.

### Introduction

The family Acanthuridae is currently represented in the Mediterranean Sea by a number of Non-Indigenous Species (NIS), some of which are considered alien, whilst others are considered as range-expanding species (Golani *et al.*, 2021). With respect to the six acanthurids listed in Evans *et al.* (2017) for the basin, namely *Zebrasoma flavescens* (Bennett, 1828), *Zebrasoma xanthurum* (Blyth, 1852), *Acanthurus monroviae* Steindachner 1876, *Acanthurus coeruleus* Bloch and Schneider, 1801, *Acanthurus chirurgus* (Bloch, 1787), *Paracanthurus hepatus* (Linnaeus, 1766), two other species belonging to the same family were recently recorded: *Acanthurus sohal* (Forsskål, 1775) and *Acanthurus* cfr *gahhm* (Forsskål, 1775) (Bariche *et al.* 2019; Karachle *et al.*, 2020). To date, only the Monrovia doctorfish *A. monroviae* and the blue tang surgeonfish *A. coeruleus*, both of Atlantic origin, appear to have established populations in the basin, while the records of the remaining acanthurid species are still con-

sidered to be casual (Evans *et al.*, 2017; Marcelli *et al.*, 2017).

In the present study, *Acanthurus xanthopterus* Valenciennes, 1835 is reported for the first time from the Mediterranean Sea, specifically from Egyptian waters. To date, it is unknown whether *A. xanthopterus* has established a viable population at the recorded Mediterranean locality, given that the species has simply been reported through a single record. Potential routes of introduction of the yellowfin surgeonfish into the Mediterranean waters are briefly discussed.

### Material and Methods

On 28<sup>th</sup> August 2021, an unknown fish was spearfished at Sidi Gaber, Alexandria, Egypt (coordinates: 31.23672° N, 29.92711° E), 150 m from the shore, at 8 m of depth over a rocky seabed.

The underwater video (Suppl. file, Video 1) taken

during the capture as well as the photos of the fish just caught were sent to one of the Authors (M.A.) as a contribution to the <https://www.facebook.com/groups/redfishinmed/?ref=share> citizen science private platform. This platform was developed within the framework of the citizen science project “Red Sea fish in Egyptian Mediterranean waters”, conceived by one of the Authors (S.A.A.A.). Successively, the fish was frozen and deposited in the collections of the Biological Museum of the Department of Biological and Geological Sciences, Faculty of Education, Alexandria University. The lower jaw was damaged during the extraction of the spear from the body of the specimen. The thawed specimen was later photographed, measured and weighed in the laboratory. In order to ascertain the number of fin spines and vertebrae, the sample was subjected to an X-ray analysis. Measurements as well as meristic counts were carried out according to Randall (1956). The following abbreviations were used: SL, Standard length; HL, Head length.

## Results

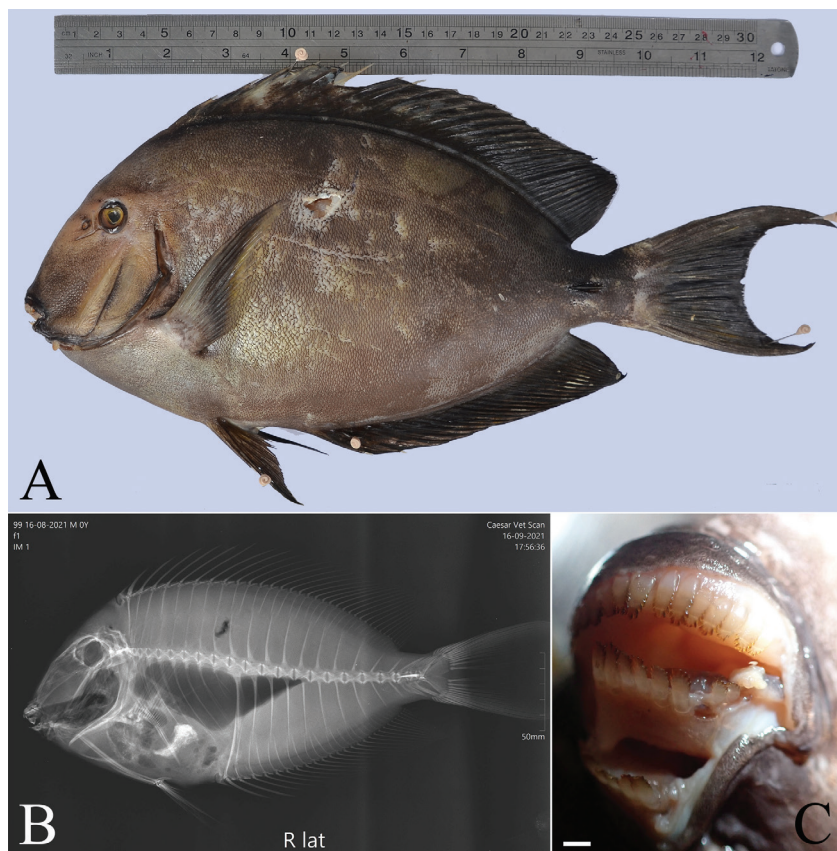
The fish specimen, having a SL of 268 mm and a weight of 687 g, was identified as *A. xanthopterus* following keys and descriptions given by Randall (1956, 1986, 2001) and Fischer & Bianchi (1984). Carpenter (2002), Carpenter & De Angelis (2016) and Allen (2020) were also consulted.

**Description.** Body deep and compressed. A continu-

ous, unnotched dorsal fin. Eye small. Mouth small, low on head. Caudal fin very lunate. A lancet-like spine positioned approximately in the middle of each side of caudal peduncle (Fig. 1A, B). Dorsal fin, IX+27; anal fin, III+25; pectoral, 16; pelvic, I+5; caudal, 18 principal rays plus 8 accessories rays (fig. 1B); first gill arch with 18 anterior and 19 posterior gill rakers; vertebrae 22 (Fig. 1B). Teeth in a single row in both jaws, close-set, incisiform, with denticulate margins; teeth in the upper jaw more elongate than in the lower, these last appearing lightly spatulate; teeth in the upper jaw 18, in the lower jaw 19 (17 visible plus two empty cavities) (Fig. 1C). In the second tooth from the center of the upper jaw, there are three rounded denticles distally, followed by five more acute denticles decreasing in size on each side of the tooth; in the second tooth from the center of the lower left jaw, there are three rounded denticles distally, followed by four more acute denticles decreasing in size on each side, the last imperceptible (Fig. 1C).

With respect to the main measurements of the specimen (Table 1), the following proportions were obtained: HL 4.3, body depth 2.03, caudal fin concavity 6.2, snout length 5.17, longest dorsal ray 5.7, all in SL; diameter of eye 5.4, length of caudal spine 4.5, caudal peduncle depth 2.1, mouth length 5.2, all in HL.

**Colour in the living specimen (denoted from available Video 1):** body uniformly grey-violet, with yellowish dorsal and anal fin, the latter fin being banded with bluish stripes; pelvic yellowish; pectoral not uniformly yellowish, being brilliant yellow distally and darker near the or-



**Fig. 1:** The specimen of *Acanthurus xanthopterus* collected off Alexandria, Egypt: A, after the second thawing, B: X-rays, C: mouth, white bar= 1 mm [lower jaw damaged]. (Photos A and C by O.M. Nour).



**Table 1.** Morphometric measurements (mm) of the *Acanthurus xanthopterus* specimen from off Alexandria, Egypt.

Measurements	mm
Total length	356.0
Standard length	268.0
Fork length	323.0
Head length	62.7
Snout length	51.8
Eye diameter	11.7
Pre dorsal fin length	84.0
Pre pectoral fin length	69.0
Pre pelvic fin length	85.0
Pre anal fin length	130.0
Body depth	132.3
Caudal peduncle length	28.0
Caudal peduncle depth	30.0
Caudal fin concavity	43.1
Caudal spine length	14.0
Dorsal fin length	167.0
Pelvic fin length	55.0
Pectoral fin length	54.0
Anal fin length	141.0
Pre anal length	112.0
Mouth length	12.0
Length of longest dorsal ray	47.1

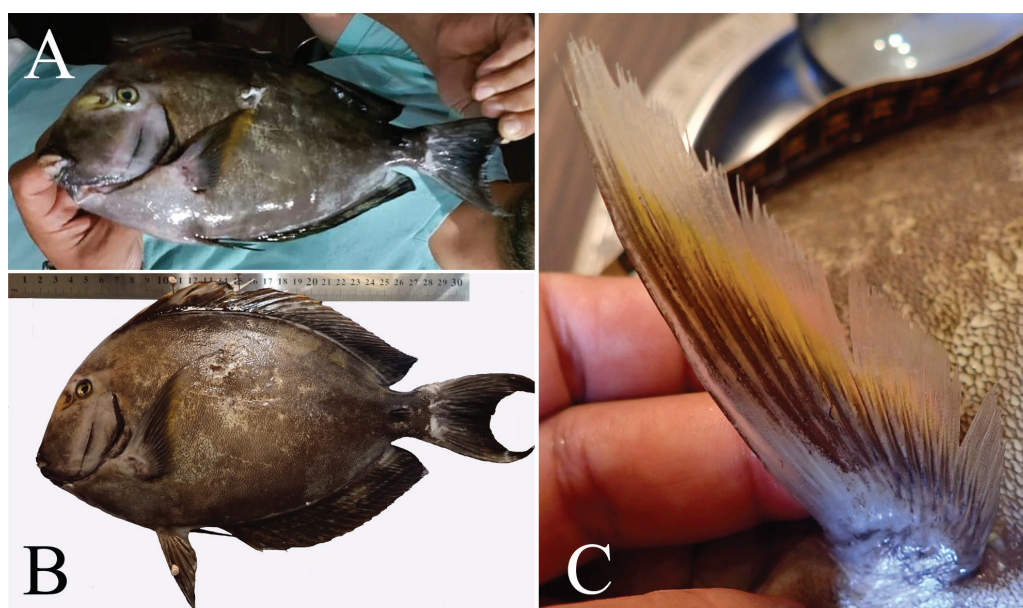
igin; a yellow area on snout, in front of the eye; posterior part of caudal peduncle, base and upper and lower rays of caudal fin white, the remaining of the caudal fin greyish; a bright band at base of dorsal and anal fins. *Colour in the freshly caught specimen* (Fig. 2A): grey-violet lightly argentous in the lower part of body and in pre-operculum and operculum; a yellow area on snout, in front of the

eye; dorsal and anal fins dark with a bright bluish band at base of both and imperceptible bluish bands visible on anal fin; pectoral fin whitish at base, then dark, outer one third yellow; pelvic fin dark; caudal fin dark brown, whitish at its base. *Colour in freshly-thawed specimen* (Fig. 2B): body brownish, less dark in pre-operculum and operculum; dorsal and anal fins dark, with four light bluish bands in the anal fin, and light faded bluish bands less evident in dorsal fin; a bright band at base of dorsal and anal fins; pectoral fin whitish at base, then dark, outer one-third yellow except extreme distal part which is hyaline (Fig. 2C); pelvic fin brownish; caudal fin dark brown, whitish at its base and on upper and lower rays; caudal peduncle spine surrounded by a thin line darker than the body; a yellow area in front of the eye.

## Discussion

The description, meristic counts, morphometric proportions and colour of the adult fish specimen hereby reported agreed with those for *A. xanthopterus* as described in Randall (1956, 1986, 2001; Moazzam *et al.*, 2017) and allowed us to distinguish it from other *Acanthurus* spp. already recorded in the Mediterranean and from similar *Acanthurus* spp. distributed worldwide.

The yellowfin surgeonfish *A. xanthopterus* is one of several marine fish that change colour with age, making misidentification more likely. In particular, *A. xanthopterus* may be confused with *A. mata* (Cuvier, 1829) and *A. dussumieri* Valenciennes, 1835, from which the yellowfin surgeonfish can be distinguished through the presence of four longitudinal blue bands and a blue-grey band at the base of the dorsal and anal fins and the yellow colour of the outer one-third of the pectoral fin (Randall, 1956, 2001; De Bruin *et al.*, 1995). In our case, the colour of the adult whilst still alive and photos taken soon after its preservation allowed us to distinguish our specimen



**Fig. 2:** *Acanthurus xanthopterus* from off Alexandria, Egypt, freshly caught (A) (Photo by M. Adel), freshly-thawed (B) and left pectoral fin (C, detail of B) (Photo credits: O.M. Nour).

from these two congeneric species, in particular through the yellow outer one-third of the pectoral fin. Moreover, there are some characteristics that distinguish *A. xanthopterus* from *A. nigrofuscus* (Forsskal, 1775), an Indo-Pacific/Red Sea inhabitant, and *A. gahhm*, endemic to the Red Sea and to the Gulf of Aden (Randall, 1987; Khalaf & Disi, 1997; Golani & Fricke, 2018; Bogorodsky & Randall, 2019). For instance, in *A. nigrofuscus*, the maximum total length is 21 cm, the number of teeth in the upper and lower jaw is 14 and 16 (adult) respectively, the anterior gill rakers are 21-24, anal fin III+22-24, a black spot in axil of dorsal and anal fin are present (absent in *A. xanthopterus*), caudal fin with a white posterior border (white base in *A. xanthopterus*) (Randall, 1956, 2001). In our specimen, the TL value was significantly higher than the maximum length achieved by *A. nigrofuscus* and all the above characteristics as well as the yellow outer one-third of pectoral fin were in agreement with the description of *A. xanthopterus* given by Randall (1956, 2001). The black surgeonfish *A. gahhm* is a large dark brown fish with a single horizontal black band on the shoulder and a white bar at the base of the caudal fin (Randall, 1987; Khalaf & Disi, 1997). The white colour at the base of the caudal fin of our specimen appeared similar to that in *A. gahhm*, but in our sample, whilst still alive, the background grey-violet body colour, the yellowish fins and the absence of the horizontal black band on the shoulder enabled us to distinguish it from live specimens of *A. gahhm*, as shown for example in Debelius (2011) and Bogorodsky & Randall (2019). Apart from *A. gahhm*, reported for the first time in the Mediterranean as *A. cf. gahham* from Salamina, Greece, in 2019 (Karachle *et al.*, 2020), the other *Acanthurus* spp. recorded to date in the basin (*A. monroviae*, *A. coeruleus*, *A. chirurgus*, *A. sohal*) do not show particular resemblance to our fish.

The yellowfin surgeonfish *A. xanthopterus* is probably the largest species of the genus *Acanthurus*, since it may exceed 500 mm in standard length; it occurs as solitary individuals or in small-medium sized aggregations, prevalently in lagoons and bays, but may also be encountered in outer reef areas, usually at depths greater than 10 to 15 m, being reported from maximum depths of 90 m. It is a grazer/detritivorous diurnal fish that feeds on benthic algae, on the fine film of diatoms and detritus on sand and even on hydroids (Randall, 1956, 2001; Grove & Lavenberg, 1997).

The species is widely distributed in the Indo-Pacific, from the coasts of East Africa to the Hawaiian Islands and French Polynesia, north to southern Japan, south to the Great Barrier Reef and New Caledonia and Eastern Pacific from southern areas of the Gulf of California and Clipperton Island to Panama, the Galapagos Islands and Perú (Bray, 2019; Campos-León *et al.*, 2019; Froese & Pauly, 2021). The species is not documented within the Red Sea and Persian Gulf ichthyofauna (Randall, 2001; Golani & Fricke, 2018), although it is listed as a commercially-exploited fish of the Red Sea waters of Eritrea (Tsfamichael & Pauly, 2016).

As the majority of the acanthurids introduced into the Mediterranean, *A. xanthopterus* is a popular marine

aquarium fish (see, for example: Reefapp, 2021; Meerwasser-lexikon, 2021; The Aquarium Wiki, 2021; LiveAquaria, 2021; DeJong Marinelife, 2021; Masterfisch, 2021). The large size achieved by adult specimens makes the species suitable for grand show displays and public aquaria (LiveAquaria, 2021), while this poses a potential obstacle to its long-term upkeep within house aquaria.

To date, this single record of the yellowfin surgeonfish from Alexandria should be considered as a casual one. Further records of the species in the documented area and along the Mediterranean coasts would contribute to ascertain its survival ability and eventual establishment within this new region. Although it is too early to discuss potential pathways of introduction of the species into the basin, a hypothetical introduction of this well-known ornamental aquarium fish through its accidental or deliberate release from the aquarium/pet industry may be considered plausible (Zenetos *et al.*, 2016; Marcelli *et al.*, 2017; Al Mabruk *et al.*, 2021). Nevertheless, other human-mediated pathways of introduction should not be excluded, such as shipping or drilling platforms (Insacco & Zava, 2017). Although *A. xanthopterus* was collected in Alexandria, Egypt, a region not far from the Suez Canal and heavily affected by the entrance and establishment of alien NIS from the Red Sea through Lessepsian migration (Nour *et al.*, 2021), an autonomous, passive introduction of the yellowfin surgeonfish via this corridor appears unfeasible given that most of the existing literature does not include the Red Sea within the known range for this species.

In recent years, marine citizen science campaigns have developed all over the world, playing an essential role in ocean awareness and conservation (Sandahl & Tøttrup, 2020; Garcia-Soto *et al.*, 2021). The intensification and development of marine research, combined with the increased dissemination of scientific information, through citizen science platforms enabled by social media and innovative technological instruments, are contributing to increase data and to improve knowledge on native and non-indigenous diversity and distribution all over the Mediterranean region (Zenetos *et al.*, 2013, 2015, 2020; Tiralongo *et al.*, 2020; Deidun *et al.*, 2021), in particular along the southern part of the basin (Al Mabruk *et al.*, 2021; Nour *et al.*, 2021).

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## Supplementary data

**Video 1.** Underwater video of *Acanthurus xanthopterus* captured on the 28<sup>th</sup> of August 2021 off Sidi Gaber, Alexandria, Egypt, eastern Mediterranean Sea (31.23672° N, 29.92711° E), at 8 m of depth. (By Hossam Hosny).