Mediterranean Marine Science

Vol. 21, 2020

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https://doi.org/10.12681/mms.22853

To cite this article:

AZZURO, E., & TIRALONGO, F. (2020). First record of the mottled spinefoot Siganus fuscescens (Houttuyn, 1782) in Mediterranean waters: a Facebook based detection. *Mediterranean Marine Science, 21*(2), 448-451. doi:https://doi.org/10.12681/mms.22853

Short Communication

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.22853

First record of the mottled spinefoot *Siganus fuscescens* (Houttuyn, 1782) in Mediterranean waters: a Facebook based detection

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Handling Editor: Argyro ZENETOS

Received: 2 April 2020; Accepted: 15 April 2020; Published on line: 3 July 2020

Abstract

Thanks to the information gathered through a Facebook group, the occurrence of a new non-indigenous fish, *Siganus fuscescens* (Houttuyn, 1782), was documented for the first time in the Mediterranean Sea. A single individual was captured on March 1st 2020, within the harbor of Gioia Tauro, southern Tyrrhenian Sea (38.44428 N, 15.90459 E). Here we illustrate this new record and discuss its relevance for Mediterranean bioinvasion research.

Keywords: Non-indigenous species; rabbitfishes; *Siganus fuscescens*; social networks; early detection.

Introduction

The growing importance of biological invasions in the Mediterranean Sea has recently led to a proliferation of participatory initiatives devoted at documenting the occurrence, distribution and spread of introduced organisms (Azzurro *et al*., 2019; Giovos *et al*., 2019; Tiralongo *et al*., 2019). Several projects and campaigns are currently contributing to monitor these species, with social media and smartphone technology playing a significant role in their early detection, while at the same time enhancing public engagement, education and community capacity-building. Opportunistic observations provided by sea users, such as fishers and divers, have therefore become a new source of information, especially in the present context of budgetary restrictions and lack of other institutional resources. Among all the social media, Facebook initiatives provide the most successful experiments of this kind, which greatly amplified our capacity to track the occurrence of non-indigenous species (NIS) in the Mediterranean region (e.g. Bariche & Azzurro, 2016; Giovos *et al*., 2019; Tiralongo *et al*., 2019) as well as in other marine regions (Chamberlain, 2018). Here we capitalize the information shared through one of these Facebook groups (*Oddfish*), documenting the occurrence of a new rabbitfish species in Mediterranean waters. The Facebook group *Oddfish* hosts a dynamic forum of recreational and professional fishers, scuba divers, researchers and simple sea lovers. The group was created in June 2016 and accounts today 4773 active members.

Rabbitfishes (or spinefoots) are tropical fish of Indo-West Pacific origin belonging to the family Siganidae, which currently comprises 31 valid species (Fricke *et al*., 2020) generally classified as herbivorous. In the Mediterranean Sea, two rabbitfish of Red Sea origin, the dusky rabbitfish, *Siganus luridus* (Rüppel, 1829) and the marbled rabbitfish, *Siganus rivulatus* Forsskål & Niebuhr, 1775, have historically established permanent populations in the eastern Mediterranean Sea, with recent distribution expansions documented in Italian waters (see Servello *et al*., 2019) and increasing abundances (Azzurro *et al*., 2017). There are also other two rabbitfishes, whose occurrence has been documented in the Mediterranean Sea: *Siganus javus* (Linnaeus, 1766) captured along the Syrian coasts and reported as a congress communication by Ibrahim *et al.* (2010) and *Siganus virgatus* (Valenciennes, 1835) captured in 1975 in the Adriatic Sea (Cres Island, Croatia) and preserved in the Natural History Museum of Vienna (Ahnelt, 2016).

To our best knowledge, no other rabbitfish species have been reported so far from the Mediterranean Sea.

Material and Methods

On March 1st 2020, a picture of an unrecognized fish was posted on *Oddfish*. One of the group moderators (FT) immediately contacted the fisher, checking the validity of this observation and collecting available evidences, including additional pictures. In order to gain enough time

for a proper taxonomical inspection, and in agreement with the fisher, this post was kept in stand-by until its full scientific validation and republished on April 15th. The capture was realized on March 1st 2020, with fishing rod at a depth of about 7 m, using larvae of flies as bait, inside the harbor of Gioia Tauro, located in the southern Tyrrhenian Sea (38.44428 N, 15.90459 E). The individual was photographed and measured by the same fisher and then released alive in the same place of capture.

Morphological analysis was performed on the available photos, one of them presented in Figure 1. Species identification was based on Woodland's taxonomical keys (Woodland, 1984; 1990).

Results

The Gioia Tauro individual measured 20 cm total length (TL) and it can be described as follows:

Body compressed. Head profile slightly concave above eye. Dorsal fin with 13 spines (the forward-directed spine which is typical of the rabbitfishes was not visible from the picture) and 10 soft rays. Anal fin with 7 spines and 9 soft rays. Caudal fin slightly emarginated.

Color: more than 400 pearly spots on head, trunk and caudal peduncle, round or elongated horizontally; least distance between neighboring spots about same as their diameter. Spots between first spine of dorsal fin and lateral line roughly disposed in about 6 rows and about 18 to 20 staggered rows of spots between highest point of lateral line and base of first anal-fin spine. A dark patch, a little larger than the eye, just at the origin of lateral line. Splotches of light and dark brown mottling the body and overlapping to the "basic" pattern of spots. Seven regularly spaced, dark diagonal zones barely visible. Dorsal and anal fins mottled with pearly blotches and dark spots.

The characters of the Gioia Tauro individual perfectly matched with that of the mottled spinefoot *S. fuscescens*, being its color pattern typical of a frightened and injured fish of this species (Woodland, 1984). Possible misidentifications with the white-spotted spinefoot, *Siganus canaliculatus* (Park, 1797), the streaked spinefoot, *S. javus*, and the barhead spinefoot, *S. virgatus*, were also evaluated. Following the key provided by Woodland (1984), a few clear characters such as the number of pearly spots > 400 (vs. 100–200 in *S. canaliculatus*); the number of rows of spots between first spine of dorsal fin and lateral line (4–6 in *S. fuscescens* vs. 2–3 in *S. canaliculatus*) and the general pattern of the spots can be considered as valid dichotomies for discarding a possible confusion between these two species. The same differences are also illustrated in the pictures provided by Burhanuddin & Budimawan (2014). The distinctions with *S. javus* are even more pronounced. Indeed, the general morphology and colour pattern of this latter species are markedly different from *S. fuscescens,* because of the body markedly deeper and the silvery blue undulating stripes on mid and lower sides. Finally, *S. virgatus* shows a totally different colour pattern, characterized by the presence of two dark bars: the first running from the lower part of the mouth to the eye (sometimes extending up to the first spine of the dorsal fin) and the second from the base of the pectoral fin to the bases of the 4th and 5th dorsal fin spines.

Discussion

This work documents the occurrence of a new rabbitfish species in the Mediterranean Sea. According to our best knowledge, and based on the adopted taxonomical keys (Woodland, 1984), the recorded characters, including specificities of the colour pattern can be considered

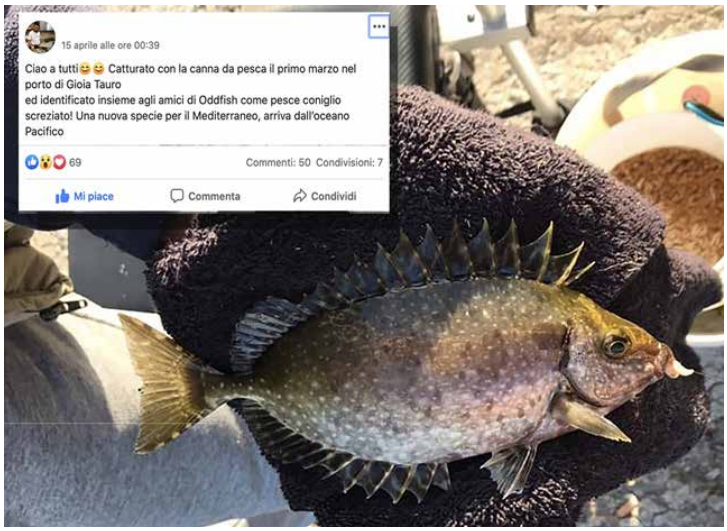

Fig. 1: The mottled spinefoot *Siganus fuscescens* caught in the harbour of Gioia Tauro (Tyrrhenian Sea: 38.44428 N, 15.90459 E) on March 1st 2020 at a depth of about 7 m. The fish is photographed alive measured 20 cm TL. The fish bait and hook are still in the mouth of the fish. A screenshot of the Facebook post is also shown (available at: https://www.facebook.com/photo.php?fbid=2397747120485890&set=gm.2573435486272639&type=3&theater&ifg=1).

as sufficient to assign the species to *S. fuscescens* and to clearly differentiate it from other rabbitfish, including the closely related *S. canaliculatus*. Certainly, due to the high morphological similarity between *S. fuscescens* and *S. canaliculatus*, we regret that further taxonomical attributes, such as the number of medial gill rakes (18–23 in *S. canaliculatus* vs. 24–29 in *S. fuscescens*) (Woodland, 1990; Nakabo, 2002) could not be checked. Further work is probably needed to clarify within-species morphological variations, since *S. canaliculatus* and *S. fuscescens* may interbreed (Yamaoka *et al*., 1994; Hsu *et al*., 2011) and there are thought to be several taxonomic ambiguities in this species complex (Ravago-Gotanco *et al*., 2018).

Considering that the native distribution of *S. fuscescens* (and also of *S. canaliculatus*) is limited to the Western Pacific Ocean (Froese & Pauly, 2020), we can exclude its arrival through the Suez Canal. On the contrary, a ship mediated introduction of *S. fuscescens* remains highly possible, since the individual has been captured within a large commercial harbor, as it happened for many other ship-born introductions of fish species in the Mediterranean (reviewed by Azzurro *et al*., 2019). Ship transport can be either due ballast waters or to slow-going shipping traffic like the long-distance transference of drilling platforms. Interestingly, Wonham *et al.* (2000) listed 32 fish transported by ballast waters, including a single rabbitfish (*Siganus rivulatus*), which survived a 29 days' transport, from Israel to the east coast of the USA.

Finally, the fundamental contribution of social networks in the timely detection of non-indigenous species in the Mediterranean Sea should be acknowledged with reference to what is requested globally by the Aichi Target 9 of the Convention on Biological Diversity (CBD, 2015) and regionally, by the "Descriptor 2" of the European Union Marine Strategy Framework Directive (EU, 2008). The timely detection of these newcomers and their accurate identification is particularly important for potential invaders such as the mottled rabbitfish, which is a voracious herbivorous species, responsible of severe ecological impacts in eastern and western Australia as well as in Japan (revised by Nielsen *et al*., 2017).

The fact that the Gioia Tauro individual was captured and released alive reinforces the need of improving the dialogue between researchers and sea users and the importance of providing information on best practices, such as avoiding the release of potential invaders in the natural environment. It is therefore essential to maintain active the role of local communities in the process of detecting and reporting these occurrences. As a matter of fact, participatory initiatives supported by the social network technology are greatly amplifying our observation potential in the Mediterranean region. Thousands of people organized in such networks, provide all together a powerful system for early detection and an effective, improved basis for environmental monitoring and community building across boundaries and jurisdictions.

Acknowledgements

We are very grateful to Daniele Addario, the fisher who posted its capture to 'Oddfish' and provided us the photos of the specimen and to Fabio Gironi for proof reading. The Facebook group 'Oddfish' is available at https://www.facebook.com/groups/1714585748824288/ and it is associated to the citizen science initiative 'Seawatchers' https://www.seawatchers.net/. This study has been partially supported by the Interreg Med Programme (Project MPA-ENGAGE -grant number: 5216 | 5MED18_3.2_M23_007).

References

Ahnelt, H., 2016. Translocations of tropical and subtropical marine fish species into the Mediterranean. A case study based on *Siganus virgatus* (Teleostei: Siganidae). *Biologia*, 71 (8), 952-959.

Azzurro, E., Bolognini, L., Dragičević, B., Drakulović, D., Dulčić, J. *et al*., 2019. Detecting the occurrence of indigenous and non-indigenous megafauna through fishermen knowledge: A complementary tool to coastal and port surveys. *Marine Pollution Bulletin*, 147, 229-236.

Azzurro, E., Franzitta, G., Milazzo, M., Bariche, M., Fanelli, E., 2017. Abundance patterns at the invasion front: the case of *Siganus luridus* in Linosa (Strait of Sicily, Central Mediterranean Sea). *Marine and Freshwater Research*, 68 (4), 697-702.

Bariche, M., Azzurro, E., 2016. Enhancing early detection through social networks: a Facebook experiment. *Rapport Commission Internationale Mer Méditerranée*, 41, 413.

Burhanuddin, A.I., Budimawan, S., 2014. The rabbit-fishes (Family Siganidae) from the coast of Sulawesi, Indonesia. *International Journal of Plant, Animal and Environmental Sciences*, 4 (4), 95-102.

Chamberlain, J., 2018. Using Social Media for Biomonitoring: How Facebook, Twitter, Flickr and Other Social Networking Platforms Can Provide Large-Scale Biodiversity Data. 2018. In: *Next Generation Biomonitoring: Part 2*. Bohan, D.A., Dumbrell, A.J., Woodward, G., Jackson, M. (Eds). *Advanced in Ecological Research*, 59, 133-168.

Convention on Biological Diversity (CBD), 2015. *Aichi Biodiversity Targets*. https://www.cbd.int/sp/targets (Accessed 11 May 2020).

EU, 2008. Directive 2008/56/EC of the European Parliament and the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). *Official Journal of the European Union* L 164(19), 22 pp.

Fricke, R., Eschmeyer, W.N., Van der Laan, R. (Eds), 2020. *Eschmeyer's catalog of fishes: genera, species,references.* http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

Froese, R., Pauly, D., 2020. *FishBase*. www.fishbase.org (Accessed 18 March 2020)

Giovos, I., Kleitou, P., Poursanidis, D., Batjakas, I., Bernardi, G. *et al*., 2019. Citizen-science for monitoring marine invasions and stimulating public engagement: a case project

from the eastern Mediterranean. *Biological Invasions*, 21 (12), 3707-3721.

Hsu, T.H., Adiputra, Y.T., Burridget, C.P., Gwo, J.C., 2011. Two spinefoot colour morphs: mottled spinefoot *Siganus fuscescens* and white-spotted spinefoot *Siganus canaliculatus* are synonyms. *Journal of Fish Biology*, 79, 1350-1355.

Ibrahim, A., Lahlah, M., Kassab, M.Y., Ghanem, W., Ogaily, S., 2010. *Signatus javus*, a new record from the Syrian waters, with a reference to growth & feeding of two lessepsian fish *Rapports Commission Internationale Mer Méditerranée*, 39, 544.

Nakabo, T., 2002. *Fishes of Japan with pictorial keys to the species*. English Edition. Tokai University Press, Tokyo, 1749 pp.

Nielsen, S., Walburn, J.W., Verges, A., Thomas, T., Egan, S., 2017. Microbiome patterns across the gastrointestinal tract of the rabbitfish *Siganus fuscescens*. *PeerJ*, 5, e3317.

Ravago-Gotanco, R., de la Cruz, T.L., Pante, M.J., Borsa, P., 2018. Cryptic genetic diversity in the mottled rabbitfish *Siganus fuscescens* with mitochondrial introgression at a contact zone in the South China Sea. *PLoS ONE*, 13 (2), e0193220.

Servello, G., Andaloro, F., Azzurro, E., Castriota, L., Catra, M. *et al.*, 2019. Marine alien species in Italy: a contribution to the implementation of descriptor D2 of the Marine Strategy Framework Directive. *Mediterranean Marine Science*, 20 (1), 1-48.

Tiralongo, F., Lillo, A.O., Tibullo, D., Tondo, E., Lo Martire, C. *et al*., 2019. Monitoring uncommon and non-indigenous fishes in Italian waters: One year of results for the AlienFish project. *Regional Studies in Marine Sciences*, 28, 100606.

Wonham, M.J., Carlton, J.T., Ruiz, G.M., Smith, L.D., 2000. Fish and ships: relating dispersal frequency to success in biological invasions. *Marine Biology*, 136, 1111-1121.

Woodland, D.J., 1984. Family Siganidae. In: *FAO species identification sheets for fishery purposes, Western Indian Ocean (Fishing Area 51)* Vol. 4. Fisher, W., Bianchi, G. (Eds). FAO, Rome.

Woodland, D.J. (Ed.), 1990. Revision of the fish family Siganidae with descriptions of two new species and comments on distribution and biology. Indo-Pacific Fishes, Vol. 19. Bernice Pauahi Bishop Museum, Honolulu, Hawaii, 136 pp.

Yamaoka, K., Kita, H., Taniguchi, N., 1994. Genetic relationships in siganids from southern Japan. p. 294-316. In: *Proceeding Fourth Indo-Pacific Fish Conference*, Kasetsart University, Bangkok.