

A new exotic fish for the Mediterranean Sea: *Chaetodon auriga* Forsskål, 1775 (Perciformes: Chaetodontidae)

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Handling Editor: Argyro Zenetos

Received: 20 May 2018; Accepted: 20 August 2018; Published on line: 20 September 2018

Abstract

The presence of *Chaetodon auriga* Forsskål, 1775 is reported for the first time from the Mediterranean Sea. A specimen was spearfished in 2015 in the central Mediterranean Sea and was in all likelihood an aquarium release. This and similar cases are discussed, with particular emphasis on exotic fishes notoriously known to be commonly kept in aquarium.

Keywords: Aquarium trade; alien; accidental; Mediterranean Sea; butterflyfishes.

Introduction

Fishes of the family Chaetodontidae (Perciformes), commonly known as butterflyfishes, comprise 131 recognized species that are widespread from tropical to temperate waters of all oceans, although most of them are of Indo-West Pacific origin. Usually, they are coral reef dwellers and, for their beautiful colors, are much appreciated as aquarium fishes (McMillan *et al.*, 1999; Affonso & Galetti, 2007), although the massive harvest in order to supply the high demand of the aquarium trade has led to over-exploitation of several populations (Edwards & Shepherd, 1992).

The Threadfin Butterflyfish, *Chaetodon auriga* Forsskål, 1775, is a coastal reef-associated Indo-Pacific species, distributed longitudinally from the Red Sea and East Africa to the Hawaiian, Marquesan, and Ducie islands, and latitudinally from southern Japan to Lord Howe and Rapa islands (Froese & Pauly, 2018). This species is commonly exported as an aquarium fish, but no specific data are available on negative impacts for the populations (Myers & Pratchett, 2010).

To date, only 3 alien fish species, belonging to the family Chaetodontidae, have been reported from the Mediterranean Sea: *Chaetodon austriacus* Rüppel, 1836, *Chaetodon larvatus* Cuvier, 1831, and *Heniochus intermedius* Steindachner, 1893. These species are considered lessepsian migrants, although records remain very rare (or even single) and confined to the eastern part of the basin (Gökoglu *et al.*, 2003; Goren *et al.*, 2011; Salameh *et al.*, 2011).

Here, we report the first record of *C. auriga* in Mediterranean waters, and discuss the possible ways of introduction.

Material and Methods

On 4th June 2015, a specimen of *Chaetodon auriga* was spearfished by one of the authors (RL) in Capo Miseno (Fig. 1A) (Tyrrhenian Sea) at a depth of about 2 m (40.7869812° N, 14.0739581° E). The fish (Fig. 1B, Fig. 1C) was caught among breakwater blocks laying on sandy bottom. The specimen was photographed, identified and frozen. Subsequently, on 5th May 2018, the fish was slowly thawed, preserved in alcohol (Fig. 1D) and analyzed in the laboratory of Ente Fauna Marina Mediterranea, within the project “AlienFish” (<https://entefau-namarinamediterranea.it/progetti-di-ricerca>).

All the main morphometric and meristic characters were investigated and the stomach was analyzed in search of prey items. After analysis, the fish was deposited in the zoological collection of Ente Fauna Marina Mediterranea with code #EFMM-040615.

Results

The main morphometric and meristic measurements are reported in Table 1. Meristic features of our specimen were compared with those reported by Randall *et al.* (1977). They were, respectively, D, XIII + 25 versus D, XIII + 23–25 and A, III + 21 versus A, III + 20–22. All chromatic and meristic features match with those of *C. auriga*. The black “eye-spot” on the soft dorsal fin



Fig. 1: (A) The black circle indicates the area in which the specimen of *Chaetodon auriga* was caught (central Mediterranean Sea); (B) the specimen of *C. auriga* caught (spearfished); (C) The specimen of *C. auriga* with a specimen of *Diplodus sargus*; (D) the specimen of *C. auriga* after preservation in alcohol.

Table 1. Morphometric and meristic measurements for *C. auriga*.

Measurements	
Total length	121 mm
Standard length	105 mm
Body depth	66 mm
Eye diameter	9 mm
Dorsal fin rays	XIII + 25
Anal fin rays	III + 21

was present (usually absent in specimens from the Red Sea). Stomach content analysis revealed the presence of remains of polychaetes: 7 specimens of *Serpula concharum* Langerhans, 1880 and 1 specimen of *Vermiliopsis striaticeps* (Grube, 1862).

Discussion

Although *C. auriga* is reported from the Red Sea, considering the great distance to the Tyrrhenian Sea (central Mediterranean Sea) and the fact that no other records exist from the Mediterranean Sea, it is unlikely for this individual to be a Lessepsian migrant. This is further supported by the fact that the Red Sea population usually lacks the black “eye-spot” on the soft dorsal fin (DiBattista *et al.*, 2015). On the other hand, considering the fact that it is a common aquarium fish (Myers & Pratchett, 2010), the most likely vector of introduction for the species is

an intentional release from aquarium. Consequently, and following the most widely accepted definitions of alien species (Sciberras & Schembri, 2007; Occhipinti *et al.*, 2011; Essl *et al.*, 2018), the single record of *C. auriga* falls into the classification of “casual alien”: “species which find their way outside their native range but which do not seem to become established; this term is used for species which have been recorded only once or twice from the study area”.

Similar cases were previously reported from the Mediterranean Sea. In particular, the recent records of *Paracanthurus hepatus* (Linnaeus, 1766), *Abudefduf sexfasciatus* (Lacepède, 1801) and *Acanthurus sohal* Bennett, 1833, refer to single records of alien fish species that were in all likelihood introduced through aquarium releases (Marcelli *et al.*, 2016; Giovos *et al.*, 2018). Recently, Zenetos *et al.* (2016) documented for the first time an intentional release in the wild for *Lutjanus sebae* (Cuvier, 1816), recorded for the first time in the Mediterranean Sea.

Based on the definitions mentioned above, we must therefore consider all the above-mentioned species as “casual alien”; indeed, single Mediterranean records of species notoriously known as aquarium fish are considered “accidental” (not established) species, at least in a first phase. The good state of health of the specimen of *C. auriga* reported in this study and the presence of prey items in the stomach, suggested that the specimen was able to survive in the Mediterranean, at least during warm months.

In contrast to established alien species that require attention, “casual alien” species have little impact on the Mediterranean ecosystem. However, aquarium releases represent a potential risk of biological invasion from sev-

eral fish species (Maceda-Veiga *et al.*, 2013) and need further attention in order to prevent and reduce the introduction of new alien species into the Mediterranean Sea.

Acknowledgements

We are grateful to Professor Giacomo Bernardi from the University of California Santa Cruz and to Dr. Andrew Fox (Managing Director Rodney Fox Shark Expeditions Adelaide, South Australia) for English revision and to the two anonymous reviewers for their helpful comments.

References

- Affonso, P.R., Galetti, P.M., 2007. Genetic diversity of three ornamental reef fishes (Families Pomacanthidae and Chaetodontidae) from Brazilian coast. *Brazilian Journal of Biology*, 67 (4), 925-933.
- DiBattista, J.D., Waldrop, E., Rocha, L.A., Craig, M.T., Berumen, M.L. *et al.*, 2015. Blinded by the bright: a lack of congruence between color morphs, phylogeography and taxonomy for a cosmopolitan Indo-Pacific butterflyfish, *Chaetodon auriga*. *Journal of Biogeography*, 42, 1919-1929.
- Edwards, A.J., Shepherd, A.D., 1992. Environmental implications of aquarium-fish collection in the Maldives, with proposal for regulation. *Environmental Conservation*, 19 (1), 61-72.
- Essl, F., Bacher, S., Genovesi, P., Hulme, P.E., Jeschke, J.M. *et al.*, 2018. Which taxa are alien? Criteria, applications, and uncertainties. *BioScience*, 68 (7), 496-509.
- Froese, R., Pauly, D., 2018. *FishBase*. www.fishbase.org. (accessed 05/2018).
- Giovos, I., Bernardi, G., Romanidis-Kyriakidis, G., Marmara, D., Kleitou P., 2018. First records of the fish *Abudefduf sexfasciatus* (Lacepède, 1801) and *Acanthurus sohal* (Forsskal, 1775) in the Mediterranean Sea. *BioInvasions Records*, 7 (2), 205-210.
- Gökoglu, M., Bodur, T., Kaya, Y., 2003. First record of the Red Sea bannerfish (*Heniochus intermedius* Steindachner, 1893) from the Mediterranean Sea. *Israel Journal of Zoology*, 49, 324-325.
- Goren, M., Gvili, R., Galil, B.S., 2011. The reef-associating butterfly fish *Chaetodon austriacus* Rüppell, 1836 in the Mediterranean: The implication of behavioral plasticity for bioinvasion hazard assessment. *Aquatic Invasions*, 6 (1), s143-s145.
- Maceda-Veiga, A., Escribano-Alacid, J., de Sostoa, A., Garcia-Berthou, E., 2013. The aquarium trade as a potential source of fish introduction in southwestern Europe. *Biological Invasion*, 15 (12), 2707-2716.
- Marcelli, M., Dayan, A.R., Langeneck, J., 2016. Finding Dory: first record of *Paracanthurus hepatus* (Perciformes: Acanthuridae) in the Mediterranean Sea. *Marine Biodiversity*, 47, 599-602.
- Myers, R., Pratchett, M., 2010. *Chaetodon auriga*. *The IUCN Red List of Threatened Species 2010*: e.T165631A6073721.
- McMillan, W.O., Weigt, L.A., Palumbi, S.R., 1999. Color pattern evolution, assortative mating, and genetic differentiation in brightly colored butterflyfishes (Chaetodontidae). *Evolution*, 53 (1), 247-260.
- Occhipinti-Ambrogi, A., Marchini, A., Cantone, A., Castelli, A., Chimenz, C. *et al.*, 2011. Alien species along the Italian coasts: an overview. *Biological Invasions*, 13 (1), 215-237.
- Randall, J.E., Allen, G.R., Steene, R.C., 1977. Five probable hybrid butterflyfishes of the genus *Chaetodon* from the central and western Pacific. *Records of the Western Australian Museum*, 6 (1), 3-26.
- Salameh, P., Sonin, O., Edelis, D., Golani, D., 2011. First record of the Red Sea Orangeface Butterflyfish *Chaetodon larvatus* Cuvier, 1831 in the Mediterranean. *Aquatic Invasions*, 6 (1), s53-s55.
- Sciberras, M., Schembri, P.J., 2007. A critical review of records of alien marine species from Maltese Islands and surroundings waters (Central Mediterranean). *Mediterranean Marine Science*, 8 (1), 41-66.
- Zenetos, A., Apostolopoulos, G., Crocetta, F., 2016. Aquaria kept marine fish species possibly released in the Mediterranean Sea: first confirmation of intentional release in the wild. *Acta Ichthyologica et Piscatoria*, 46 (3), 255-262.