

SHORT COMMUNICATION

First record of the yellowbar angelfish *Pomacanthus maculosus* (Forsskål, 1775) (Actinopterygii: Pomacanthidae) in the Hellenic Seas

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Abstract: The present study reports the first confirmed occurrence of the yellowbar angelfish *Pomacanthus maculosus* (Forsskål, 1775) in Hellenic waters, extending the known Mediterranean distribution of this West Indian Ocean species. A single adult specimen was collected by spearfishing on 15 October 2025 from shallow coastal waters off southern Crete. Identification was based on distinctive coloration patterns, morphological characteristics, and meristic counts. The habitat consisted of steep rocky substrates adjacent to sandy plains, aligning with the known ecological preferences of the species. Possible introduction pathways are examined, with aquarium release or escape and natural westward range expansion from established Levantine populations considered as non-exclusive scenarios. This record bridges an apparent distributional gap between eastern and central Mediterranean records, which may partly reflect limited detectability due to the species' cryptic habits rather than true absence. The finding underscores the importance of Crete as a strategic monitoring area for detecting the arrival and potential spread of marine non-indigenous species within Hellenic waters. Continued surveillance is essential to assess establishment and potential ecological implications.

Keywords: non-indigenous species (NIS); Lessepsian migration; aquarium trade; Levantine Sea; eastern Mediterranean Sea; spearfishing; range expansion

Sažetak: PRVI ZABILJEŽENI NALAZ VRSTE *POMACANTHUS MACULOSUS* (FORSSKÅL, 1775) U GRČKIM VODAMA. U radu se opisuje prvi zabilježeni nalaz vrste *Pomacanthus maculosus* (Forsskål, 1775) u grčkim vodama, čime se šire saznanja o poznatoj distribuciji ove vrste, podrijetlom iz zapadnog Indijskog oceana, u Sredozemnom moru. Jedan odrasli primjerak ulovljen je podvodnom puškom 15. listopada 2025. godine u plitkim obalnim vodama južno od otoka Krete. Identifikacija je provedena na temelju karakteristične obojenosti te morfoloških i merističkih obilježja. Stanište se sastojalo od strme stjenovite podloge uz pješčanu zaravan na dnu, što je u skladu s poznatim ekološkim preferencijama ove vrste. Razmotreni su mogući putevi unosa, pri čemu se kao međusobno neisključivi scenariji ističu prirodno širenje areala prema zapadu iz već uspostavljenih levantinskih populacija te puštanje ili bijeg iz akvarija. Ovaj nalaz premošćuje prividni distribucijski jaz između zapadnih i središnjih mediteranskih nalaza, koji može djelomično odražavati i ograničenu mogućnost detekcije vrste zbog kriptičnog načina života, umjesto stvarne odsutnosti na tom području. Nalaz naglašava važnost otoka Krete kao strateški važnog područja za praćenje dolaska i potencijalnog širenja morskih alohtonih vrsta u grčkim vodama. Kontinuirani nadzor nužan je kako bi se procijenilo eventualno uspostavljanje populacije i moguće ekološke posljedice.

Ključne riječi: alohtone vrste (NIS); lesepsijska migracija; akvarijska trgovina; Levantsko more; istočno Sredozemno more; podvodni ribolov; širenje areala

INTRODUCTION

Crete represents one of the most dynamic fronts of marine biological invasions in the eastern Mediterranean, driven by its warm waters, island geomorphology, and close biogeographical connection with the Levantine basin. Recent monitoring has revealed that the first records of non-indigenous species (NIS) around Crete have often been underestimated or backdated, confirming a persistent and accelerating influx of NIS taxa (Galanidi *et al.*, 2025). Broader regional inventories show that many of the more than 230 marine NIS record-

ed in Greece have already extended their range into the Cretan Seas, where warming trends and maritime traffic intensify invasion pressure (Zenetos and Galanidi, 2020; Zenetos *et al.*, 2025). These findings highlight the need for continuous surveillance and integrated management to mitigate the ecological and socio-economic impacts of biological invasions on the island.

The yellowbar angelfish *Pomacanthus maculosus* (Forsskål, 1775) is a Western Indian Ocean fish species with a natural distribution range extending from the Persian Gulf and the Red Sea to Mozambique, East Africa (Froese and Pauly, 2025). As an introduced species, it has

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Received: 23 January 2026, accepted: 10 March 2026

ISSN: 0001-5113, eISSN: 1846-0453

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been recorded in the Mediterranean Sea (Bariche, 2010; Salameh *et al.*, 2012; Evans *et al.*, 2016; Al Mabruk *et al.*, 2021; Golani *et al.*, 2021; Capapé *et al.*, 2023), the western Atlantic (Brazil and Florida), the eastern Atlantic (Canary Islands), and the central and eastern Pacific (Semmens *et al.*, 2004; Brito *et al.*, 2005; Soeth *et al.*, 2018; Zavala-Jiménez, 2022; Froese and Pauly, 2025).

The yellowbar angelfish inhabits shallow reefs and is more often found over silty reef areas than in areas with dense coral growth (Froese and Pauly, 2025). It is one of the largest angelfish species, reaching almost 50 cm in standard length (SL) (Sommer *et al.*, 1996) and has a maximum reported age of 36 years (Grandcourt *et al.*, 2010).

In adults, the species exhibits a characteristic color pattern, being light blue with an elongate oval-shaped yellow blotch situated laterally, and post-medially beneath the dorsal fin, and a pale caudal fin (Bariche, 2010). Its striking and appealing coloration makes it highly valued in the marine ornamental fish trade (Okemwa *et al.*, 2016). In fact, *P. maculosus* is highly priced and can reach up to approximately 450,00 € per specimen in the European markets (e.g., SIMS Tropical Fish, 2026).

Herein, we report the first confirmed record of *P. maculosus* in the Hellenic waters, based on a single individual collected from the coastal waters of southern Crete. This record extends the known distribution of the species in the Mediterranean Sea and fills a geographic gap between previously documented eastern and central Mediterranean occurrences. The present study provides morphological, morphometric and meristic data for the

examined specimen and compares them with published Mediterranean records. Possible pathways of introduction to Cretan waters are briefly discussed, with particular reference to aquarium release or escape and natural westward range extension of this species, which is considered a Lessepsian migrant, introduced to the Levantine waters through the Suez Canal (Golani and Fricke, 2018; Golani *et al.*, 2021; Heemstra, 2022).

MATERIAL AND METHODS

On 15 October 2025, one individual of *Pomacanthus maculosus* was captured by a spearfisher at approximately eight meters depth at Mavronisi, southern Crete (34° 55' 58.73" N, 24° 48' 36.72" E) and subsequently provided to the authors. While fresh, the specimen was photographed, measured and described. Measurements were taken to the nearest mm with a digital caliper and weighed to the nearest gram. After preservation in absolute ethanol, it was registered in the collection of the Hydrobiological Station of Rhodes/Hellenic Centre for Marine Research, with a Voucher number HSR581.

RESULTS AND DISCUSSION

The collected specimen was identified as *Pomacanthus maculosus* (Fig. 1) following Allen *et al.* (1998) and Heemstra (2022). The specimen measured 15.8 cm in total length (TL) and 12.6 cm in standard length (SL), with a total weight (TW) of 126 g (Table 1). The body is



Fig. 1. *Pomacanthus maculosus* (Forsskål, 1775) specimen collected at Mavronisi, southern Crete (34° 55' 58.80" N, 24° 48' 36.72" E) on 15 October 2025. Photo credit: Chrysa Doxa.

Table 1. Published *Pomacanthus maculosus* records in the Mediterranean Sea. TL = Total length, SL = Standard length; TW = Total weight; D = Dorsal spines and soft rays; A = Anal spines and soft rays; “-” = Data not available; SE = Southeastern; SC = via Suez Canal; AT = Aquarium trade (escape or release); S = Shipping; RE = Range expansion.

Date	Country	Location	Depth (m)	Substrate	Collection method	TL-SL (mm)	W (g)	D	A	Possible pathway*	Reference
08/09/2009	Lebanon	South of Beirut (33° 48' 00.00" N, 35° 25' 59.88" E)	25	Mixed coral-ligenous-soft bottom	Spearfished	~300	-	-	-	SC; AT; S	Bariche (2010)
08/09/2009	Lebanon	South of Beirut (33° 48' 00.00" N, 35° 25' 59.88" E)	25	Mixed coral-ligenous-soft bottom	Observed	-	-	-	-	SC; AT; S	Bariche (2010)
26/07/2011	Israel	Near Tel Shiqmona, southern edge of Haifa Bay (32° 49' 26.76" N, 34° 56' 48.84" E)	10	-	Spearfished	337-279	1317.5	XI+20	III+19	SC	Salameh <i>et al.</i> (2012)
12/2012	Malta	Marsaxlokk Harbour (35° 49' 48.00" N, 14° 33' 14.40" E)	~10	Dumped boulders with turf algae over a silty bottom	Spearfished	~250	-	-	-	AT or S	Evans <i>et al.</i> (2016)
08/08/2015	Israel	8.5km off Tel Aviv (32° 09' 03.60" N, 34° 42' 10.80" E)	45	“Electrodag” shipwreck	Photographed	~400	-	-	-	-	Stern <i>et al.</i> (2019)
20/09/2015	Malta	SE coast (35° 49' 13.08" N, 14° 33' 45.72" E)	15	-	Harpooned	-	200	-	-	AT	Evans and Schembri (2017)
07/2017	Israel	600 m off Tel Aviv (32° 04' 12.00" N, 34° 45' 00.00" E)	8	-	Photographed/video	-	-	-	-	-	Stern <i>et al.</i> (2019)
18/08/2018	Israel	off Ashqelon (31° 40' 48.00" N, 34° 33' 00.00" E)	4	-	Speared	~300	-	-	-	-	Stern <i>et al.</i> (2019)

* In decreasing probability, as presented by authors originally.

Continuation of Table 1

Date	Country	Location	Depth (m)	Substrate	Collection method	TL-SL (mm)	W (g)	D	A	Possible pathway*	Reference
31/08/2018	Malta	Zurrieq valley sea inlet (35° 49' 09.48" N, 14° 27' 06.48" E)	5	Rocky reef	Harpooned	–	–	–	–	–	Katsanevakis et al. (2020)
27/08/2019	Egypt	Alexandria (31° 12' 43.56" N, 29° 53' 02.76" E)	10	Mixed sand and rock	Spearfished or trolling line	–	–	–	–	–	Al Mabruk et al. (2021)
27/09/2019	Egypt	Alexandria (31° 18' 36.72" N, 30° 04' 23.52" E)	5	Sandy bottom	Spearfished	–	–	–	–	–	Al Mabruk et al. (2021)
8/10/2019	Malta	Ġnejma Bay (35° 55' 25.32" N, 14° 20' 21.12" E)	5	Sparse <i>Posidonia oceanica</i> meadows and sandy patches	Angling	–	–	–	–	–	Katsanevakis et al. (2020)
05/05/2020	Egypt	Alexandria (31° 13' 26.04" N, 29° 53' 56.40" E)	20	Sandy bottom	Spearfished	–	–	–	–	–	Al Mabruk et al. (2021)
26/9/2020	Egypt	Alexandria (31° 16' 14.52" N, 29° 59' 17.52" E)	12	Mixed sand and rock	Spearfished or trolling line	–	–	–	–	–	Al Mabruk et al. (2021)
16/06/2022	Syria	off Banias Harbour (35° 13' 41.88" N, 35° 55' 31.08" E)	3	Total depth ~80 m	Observed	–	–	–	–	RE; AT or S	Capapé et al. (2023)
16/06/2022	Syria	off Banias Harbour (35° 13' 41.88" N, 35° 55' 31.08" E)	3	Total depth ~80 m	Spearfished	275–222	602	XII+21	III+19	RE; AT or S	Capapé et al. (2023)
15/10/2025	Greece	south Crete (34° 55' 58.80" N, 24° 48' 36.72" E)	8	Steep cliffs adjacent to sandy plains	Spearfished	158–126	126	XII+21	III+19	RE or AT	Present study

* In decreasing probability, as presented by authors originally.

laterally compressed and almost circular. A hard spine is present at the angle of the preopercle. There are elongate extensions on the hind margin of both dorsal and anal fins. The caudal fin is rounded. The body bears large and small scales, irregularly arranged and very rough. The operculum is spineless. The coloration is characterized by purple-blue body with dark curved marking on its anterior part and the distinguishing, for the adult stage, large yellow vertical blotch on the sides of the body. Caudal fin is yellowish with irregular undulate blue lines. Some scales are present on nape and front of upper body with dark centres (Fig. 1). The pectoral fins do not reach the large vertical yellow blotches. The dorsal fin of the specimen under study comprised 12 spines and 21 soft rays, while the anal fin consisted of 3 spines and 19 soft rays. Notably, juvenile specimens exhibit a dark blue body with fine, vertical light-blue lines; a small yellow mark is present on the upper central part of the body, and the caudal fin is transparent (Golani *et al.*, 2021).

Following the morphometric protocol of Capapé *et al.* (2023), our specimen presented the following measurements: body depth 7.8 cm (49.5% TL), head length (HL) 3.7 cm (23.2% TL), eye diameter 1.1 cm (6.8% TL; 29.5% HL), snout length 1.9 cm (12.0% TL; 51.6% HL), upper jaw length 0.6 cm (3.9% TL; 16.9% HL), lower jaw length 0.7 cm (4.6% TL; 19.9% HL), dorsal fin length 12.8 cm (81.2% TL), pectoral fin length 3.7 cm (23.5% TL), pelvic fin length 5.0 cm (31.8% TL), anal fin length 7.3 cm (46.1% TL), caudal fin length 3.3 cm (20.8% TL), pre-dorsal length 5.3 cm (33.5% TL), pre-pectoral length 3.8 cm (24.2% TL), pre-pelvic length 4.8 cm (30.2% TL), and pre-anal length 7.5 cm (47.2% TL). Minor differences compared to Capapé *et al.* (2023), particularly in eye diameter, lower jaw length, and anal fin length, likely reflect slight methodological variation rather than true morphological divergence.

The morphological and meristic characteristics and the color of the examined specimen are consistent with those reported for *P. maculosus* in previous Mediterranean records (Salameh *et al.*, 2012; Capapé *et al.*, 2023) (Table 1). However, both SL and TW fall within the lower range of values documented to date in the Mediterranean Sea.

The depth range of the species is between 4 and 60 m (Froese and Pauly, 2025). The specimen from Crete was speared in shallow waters, at a depth comparable to most of those reported in previous Mediterranean records (Table 1).

The substrate at the collection site consisted of steep rocky cliffs adjacent to sandy plains, a combination of hard and soft material that has also been reported elsewhere (e.g., Evans *et al.*, 2016; Katsanevakis *et al.*, 2020).

Pomacanthus Lacepède genus comprises 13 species, of which *Pomacanthus imperator*, *P. maculosus* and *P. semicirculatus* have been recorded in the Mediterranean as NIS (Yıldız and Gökoğlu, 2024; Corsini-Foka *et al.*, 2025; Froese and Pauly, 2025). *Pomacanthus asfur* has

also been reported from the Mediterranean basin (Karachle *et al.*, 2016), but this record is most likely based on a misidentification (Evans and Schembri, 2017). This record is therefore treated as *P. maculosus*, in agreement with Evans and Schembri (2017) (Table 1).

The finding of the yellowbar angelfish *P. maculosus* described in the present study represents the first confirmed and documented species of the genus *Pomacanthus* recorded in Hellenic waters. Although *P. imperator* has been reported from the Cyclades, Aegean Sea (Zenetos *et al.*, 2025), this observation is based on a citizen science record that has not been formally validated.

Two non-exclusive vectors may explain the presence of *P. maculosus* in Hellenic waters: (i) an unaided westward range expansion of this West Indian Ocean species following its initial introduction into the eastern Mediterranean via Lessepsian migration through the Suez Canal (Golani and Fricke, 2018; Golani *et al.*, 2021; Heemstra, 2022), or, less likely, (ii) an independent introduction event through aquarium release or escape, unrelated to its prior spread within the Mediterranean Sea. These are the most probable explanations for the presence of the species in the waters of Crete, where it may have previously gone undetected. The likelihood of these vectors was evaluated by considering several arguments. Arguments that do not strongly support the aquarium release/escape hypothesis include: (i) the coastal area surrounding Mavronisi is sparsely populated and lies at a considerable distance from major population centers; and (ii) within a 100 km radius of the collection site, fewer than five aquarium shops potentially trading this species are present, while fewer than 15 are known across Crete. Nevertheless, the aquarium trade cannot be excluded as a possible vector, as it has been identified as the most likely pathway responsible for the introduction of *P. maculosus* in both the eastern and western Atlantic Ocean (Semmens *et al.*, 2004; Brito *et al.*, 2005; Soeth *et al.*, 2018).

In contrast, several arguments are consistent with the natural dispersal hypothesis. The species has been present in the Levantine basin since 2009, and therefore larval dispersal from established eastern Mediterranean populations cannot be excluded (Fig. 2). Moreover, *P. maculosus* is considered a non-migratory species that is typically solitary, forming pairs mainly during the reproductive period, which has not yet been documented in the Mediterranean Sea; thus, the occurrence of a single individual does not necessarily indicate a local aquarium release or escape.

The present record fills a distributional gap between the eastern and the western Mediterranean records (Fig. 2). However, the lack of records in intermediate regions such as Cyprus, the Mediterranean Turkish coasts, and Rhodes, areas known for high numbers of NIS records, should be interpreted with caution. The cryptic habits and benthic behavior of *P. maculosus* may substantially reduce its detectability, suggesting that its apparent absence from these regions may reflect limited observation

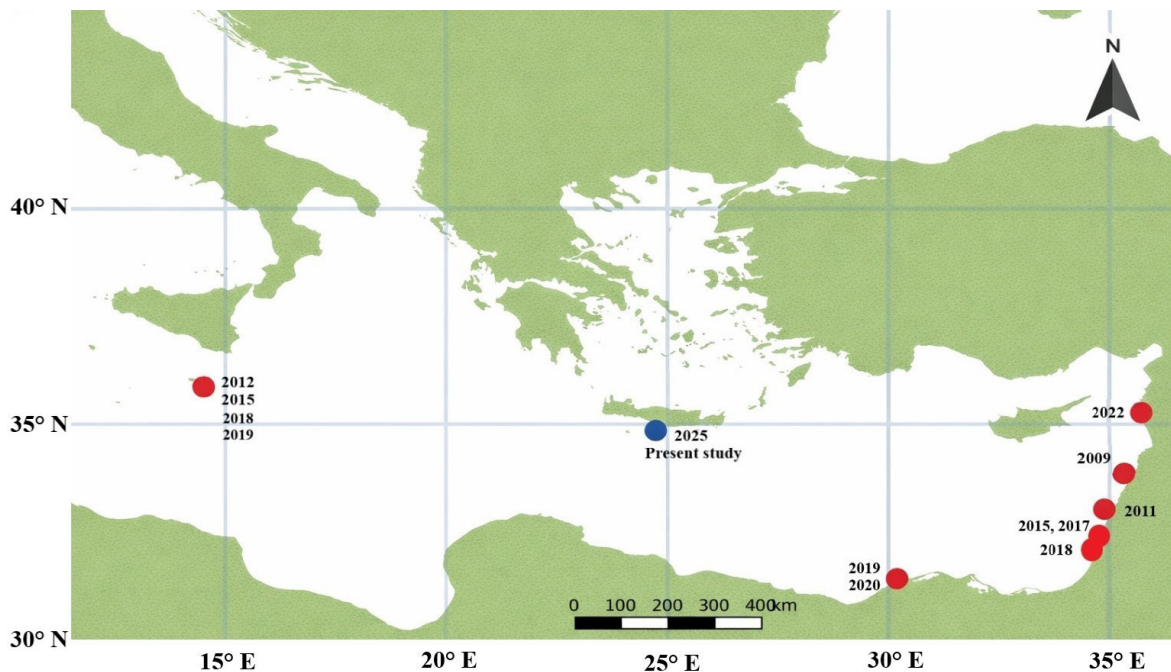


Fig. 2. Distribution map of previous and present records of *Pomacanthus maculosus* in the Mediterranean Sea. Red dots indicate previous records; blue dot denotes the present record.

rather than true absence. Targeted surveys focusing on cryptobenthic habitats are therefore required to clarify their actual distribution in the eastern and central Mediterranean. We suggest that the presence of *P. maculosus* in the coastal waters of southern Crete cannot be unequivocally attributed to any single proposed introduction pathway. Nevertheless, the individual was first observed at the collection site in early May 2025 and was repeatedly sighted in the same area during subsequent underwater observations conducted by one of the authors (M.C., pers. obs.) until its capture. These repeated sightings suggest that local environmental conditions were suitable and that sufficient prey resources were available to support its persistence in the area.

CONCLUSIONS

This study documents the first confirmed record of *Pomacanthus maculosus* in Hellenic waters, extending the known Mediterranean distribution of the species to the southern Cretan Sea. The morphological, morphometric and meristic characteristics as well as the color of the examined specimen are consistent with *P. maculosus* in its natural range and in the Mediterranean, supporting its correct identification. Although the exact pathway of introduction cannot be conclusively determined, both aquarium release or escape and natural westward range expansion from established Levantine populations, if considered a Lessepsian migrant, remain plausible, non-exclusive scenarios. The presence of this species in Crete highlights the island's role as a key monitoring area for ongoing biological

invasions in the eastern Mediterranean and underscores the importance of sustained surveillance to detect early-stage introductions of conspicuous, yet potentially overlooked, non-indigenous fishes.

ACKNOWLEDGEMENTS

Authors would like to thank the Diving center “The sea lovers” at Platia Peramata, South Crete, for providing the scuba diving equipment for the dives on 15 October 2025.

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