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SALARIA BASILISCA (ACTINOPTERYGII: BLENNIIDAE) IN MEDITERRANEAN WATERS: NEW BIOLOGICAL AND ECOLOGICAL DATA EMERGING FROM THE COLLABORATION BETWEEN CITIZEN SCIENTISTS AND RESEARCHERS

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ABSTRACT

Salaria basilisca is a blenny (Blenniidae) endemic to the Mediterranean Sea. Our current understanding of its biology and ecology is limited, and only a few scattered data are available regarding its abundance and distribution. This paper introduces the first targeted study aiming to expand our knowledge of *S. basilisca* with new data obtained through the discovery of a stable population of the species in Sicily. Several couples guarding nests were observed in August 2022 in Marsala (southwestern Sicily). The species inhabits shallow seabed areas covered with seagrass, with its spatial distribution varying between daylight and nighttime hours. Finally, the paper underlines the importance of collaboration between citizen scientists and researchers in natural sciences, as some of these new data were collected through citizen science.

Key words: combtooth blennies, Mediterranean Sea, cryptobenthic fish, citizen science, rare species

SALARIA BASILISCA (ACTINOPTERYGII: BLENNIIDAE) IN ACQUE MEDITERRANEE: NUOVI DATI BIOLOGICI ED ECOLOGICI EMERSI DALLA COLLABORAZIONE TRA SCIENZIATI CITTADINI E RICERCATORI

SINTESI

Salaria basilisca è una bavosa (Blenniidae) endemica del Mediterraneo. Le nostre attuali conoscenze sulla sua biologia ed ecologia sono limitate e sono disponibili solo pochi dati sparsi sulla sua abbondanza e distribuzione. Questo lavoro rappresenta il primo studio mirato ad ampliare le conoscenze su *S. basilisca* con nuovi dati ottenuti grazie alla scoperta di una popolazione stabile della specie in Sicilia. Nell'agosto del 2022 sono state osservate diverse coppie che custodivano nidi a Marsala (Sicilia sud-occidentale). La specie abita fondali poco profondi e ricoperti da fanerogame, con la sua distribuzione spaziale che varia tra le ore diurne e notturne. Il lavoro infine sottolinea l'importanza della collaborazione tra scienziati cittadini e ricercatori di scienze naturali, poiché alcuni di questi dati sono stati raccolti grazie al contributo della citizen science.

Parole chiave: blennidi, Mar Mediterraneo, pesci criptobentonici, citizen science, specie rare

INTRODUCTION

The Blenniidae family consists of small-sized coastal fishes with worldwide distribution, mainly inhabiting shallow marine waters and reaching their highest diversity in tropical and subtropical areas (Nelson, 1994). Currently, more than 400 species of fish belonging to this family are recognised as valid (Eschmeyer *et al.*, 2023). Most of them are cryptobenthic, living inside small holes, crevices, and encrusting organisms on hard substrates (Miller, 1996; Orlando-Bonaca & Lipej, 2007; Duci *et al.*, 2009; Tiralongo *et al.*, 2016a). In Italian waters, a total of 21 species of combtooth blennies (Blenniidae) are currently known (Tiralongo, 2015; Azzurro *et al.*, 2018). Of these, one species, *Ophioblennius atlanticus* (Valenciennes, 1836), commonly known as the redlip blenny, is a non-indigenous fish of Atlantic origin. It was first recorded in the Mediterranean Sea in 2014 in Malta (Falzon, 2015), and subsequently in Lampedusa (Strait of Sicily) and Catania (Ionian Sea) in Italian waters (Azzurro *et al.*, 2018; Ragkousis *et al.*, 2020). Another species, *Salaria fluviatilis* (Asso, 1801), commonly known as the freshwater blenny, has a circum-Mediterranean distribution and is known to inhabit fresh waters only, such as rivers and lakes (Tiralongo, 2015). The remaining 19 species inhabit marine coastal waters, with some of them tolerating brackish waters (Tiralongo, 2015; Tiralongo *et al.*, 2016a). Among Mediterranean combtooth blennies (Blenniidae), *Hypleurochilus bananensis* (Poll, 1959) and *Salaria basilisca* (Valenciennes, 1836) are the rarest species to be found in Italian waters and in the Mediterranean Sea in general (Tiralongo, 2015; Tiralongo *et al.*, 2016b; Tiralongo, 2020). While *H. bananensis* is present in low abundance within confined areas, *S. basilisca* can be locally abundant, yet scattered in distribution. Recent records of *H. bananensis* come from very small coastal areas (lagoons) of the central Tyrrhenian and northern Ionian seas (Tiralongo *et al.*, 2016b; Tiralongo, 2024), while the most recent reports of *S. basilisca* have been made from southern Sardinia, in the waters of both western and eastern sides of the Island (Tiralongo, 2015; Tiralongo *et al.*, 2020).

This report documents the first occurrence of *S. basilisca* in Sicily, providing ecological and biological notes on an established population and discussing the presence and distribution of *S. basilisca* in Italian waters and the broader Mediterranean Sea. It also underlines the importance of collaboration between citizen scientists and researchers in the field of natural sciences, as some of these new data were collected through citizen science.

MATERIAL AND METHODS

On 17 July 2022, a specimen of *S. basilisca* was found alive by a marine enthusiast in the shade on the quay of the Marsala nautical club (southwestern Sicily; 37.806844 N, 12.433331 E). The specimen was photographed and released into the nearby area (37.809599 N, 12.435930 E), where it swam to the bottom, which was covered by a *Posidonia oceanica*

meadow. Photos were posted in the specialised Facebook group “Fauna Marina Mediterranea”, which is administered by one of the authors (FT), with a request for confirmation of the species’ identity. The group, which currently hosts more than 27,000 users and several experts from various taxonomic groups, collects data on rare and non-indigenous species and promotes knowledge of the Mediterranean marine fauna through species identification and facilitating debates among people and experts (Tiralongo *et al.*, 2020).

Subsequently, the area indicated by the marine enthusiast was explored by snorkeling on 12 and 13 August 2022, in order to investigate the possible existence of a population of *S. basilisca* and collect/document relevant data on its biology and ecology. A total of 16 hours of visual surveys were conducted, both in daytime and at night, in an area extending from 37.808187 N, 12.433749 E to 37.812640 N, 12.438709 E, and including the coastal lagoon called Stagnone of Marsala, a natural reserve (Fig. 1).

An additional record of this species was provided through photographic documentation from Caprera island (northeastern Sardinia). The specimen was photographed by an amateur in July 2018 at a depth of 2 m in a *P. oceanica* meadow.

The species was identified following the description provided by Tiralongo (2015): “Body elongated and laterally well compressed. Head profile steep and arched. [...]. Ocular cirri absent. [...]. A series of double vertical dark bars irregularly spaced on sides, extending to about halfway up to the dorsal fin. These bands are darker in the dorsal area, while tend to disappear in the rear and ventral part of the body. [...]. These bands are generally dark green in color, with the frequent presence of more or less extensive brick-red bands”. This allowed us to distinguish *S. basilisca* from a similar marine species of the same genus, namely *Salaria pavo* (Risso, 1810).

RESULTS AND DISCUSSION

The specimen collected in Marsala had an estimated total length of 18 cm. It had probably been discarded by an amateur fisher (Fig. 2a).

During underwater observations, a total of about 30 specimens of *S. basilisca*, including several couples guarding eggs in nests, were recorded in the depth range of 1–3 m (Figs. 2b,c). During the day, the species was observed in the border area between *Cymodocea nodosa* and *P. oceanica* meadows. At night, all specimens hid among *P. oceanica* leaves, and no parental cares were provided to the eggs. At dawn, all specimens returned to the border area between *C. nodosa* and *P. oceanica* and the couples resumed the care of the eggs. Throughout the day, the males fought off sparids (*Diplodus* spp.) and labrids (*Coris julis*) that attempted to eat the eggs, and fanned their tails to oxygenate the egg mass and remove sand from it. The females helped the males to oxygenate and clean the eggs as well as protect them from predators, but they would often move away, disappearing in the *P. oceanica* meadow. We also recorded the presence of

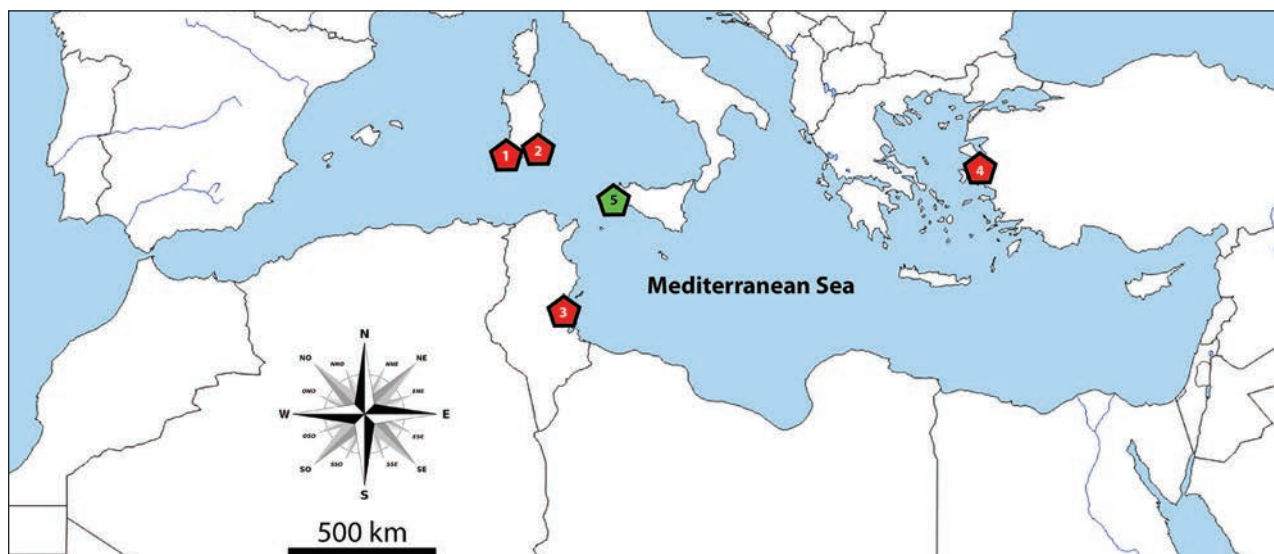


Fig. 1: Documented records of established *Salaria basilisca* populations in the Mediterranean Sea. The green polygon (number 5 in black) indicates the new record, the red ones (numbers 1–4 in white) indicate past records; 1 and 2 Sardinia (Tiralongo, 2015; Tiralongo et al., 2020); 3 Tunisia (Dulčić et al., 2008 and references therein; Barhoumi et al., 2009); 4 Turkey (Dulčić et al., 2008 and references therein); 5 new record (Sicily).

Sl. 1: Dokumentirani zapisi o pojavljanju ustaljenih populacij vrste *Salaria basilisca* v Sredozemskem morju. Zeleni poligon (številka 5 v črnem) prikazuje novi zapis o pojavljanju, rdeči poligoni (številke 1–4 v belem) pa prikazujejo stare zapise o pojavljanju; 1 in 2 Sardinija (Tiralongo, 2015; Tiralongo in sod., 2020); 3 Tunizija (Dulčić in sod., 2008 in v delu navedene reference; Barhoumi in sod., 2009); 4 Turčija (Dulčić in sod., 2008 in v delu navedene reference); 5 novi zapis o pojavljanju (Sicilija).

small sneaker males mimicking the female morphology and behaviour. In the area, we observed a massive presence of sea squirts (Ascidiacea) and, during nighttime, eels (*Anguilla anguilla*). The occurrence of couples of *S. basilisca* taking care of nests with demersal eggs in August suggests that the reproduction period covers at least the early summer period.

The specimen recorded in Sardinia (Caprera) was found alone among *P. oceanica* leaves (photo received by the authors but not included herein due to low quality). Further investigations would be necessary to verify the presence of a stable population of the species in that area.

Salaria basilisca is a species endemic to the Mediterranean Sea. There is limited knowledge about its distribution, and specific data on its biology and ecology are scarce, if not absent. The species appears to be relatively abundant only in a few areas of Italy (southern Sardinia and southwestern Sicily), Tunisia (Gulf of Gabes), and Turkey (Gulf of Izmir), where it forms stable populations (Dulčić et al., 2008; Barhoumi et al., 2009; Tiralongo, 2020). On the other hand, there are dated records of *S. basilisca* from areas where the species is considered very rare: Gulf of Genoa, the Adriatic, Ionian, Tyrrhenian, and Aegean seas (Dulčić et al., 2008 and references therein). However, targeted investigation could lead to the discovery of new stable populations in other Mediterranean areas as well. Indeed, blennies, thanks to their cryptic behaviour and small size, can easily go unnoticed during general fish surveys (Tiralongo et al., 2021).

Salaria basilisca has resulted to be associated with the presence of seagrasses and often with coastal lagoons or adjacent areas. In the area of Marsala, the species concentrated in the border area between meadows of *P. oceanica* and *C. nodosa* during daytime, but preferred the shelter offered by the leaves of *P. oceanica* at night. This behaviour could suggest that predation risk for the eggs is especially high during the day, while at night the eggs can be left unattended. Parental males likely benefit from resting during the night to recover the energy spent during the day in protecting the eggs. Another benefit gained by parental males during the night hours could be the opportunity to feed. In any case, the parental care provided by the males is essential for the development and survival of the eggs. In fact, in addition to cleaning and oxygenating the eggs, similar to what occurs in the congeneric *S. pavo*, it is very likely that males use their anal glands to release substances with antimicrobial activity onto the eggs (Pizzolon et al., 2010). Like for *S. pavo*, we also recorded the presence of small sneaker males mimicking female morphology and behaviour to approach the nests with the aim of parasitic fertilisation (Ruchon et al., 1995; Gonçalves et al., 2005). Furthermore, inside a nest, we observed the presence of a second “female” together with the parental couple. This specimen was larger in size than the parental female and was chased away by the parental male. However, there is still doubt whether it was a larger non-parental female or a female mimicry male.

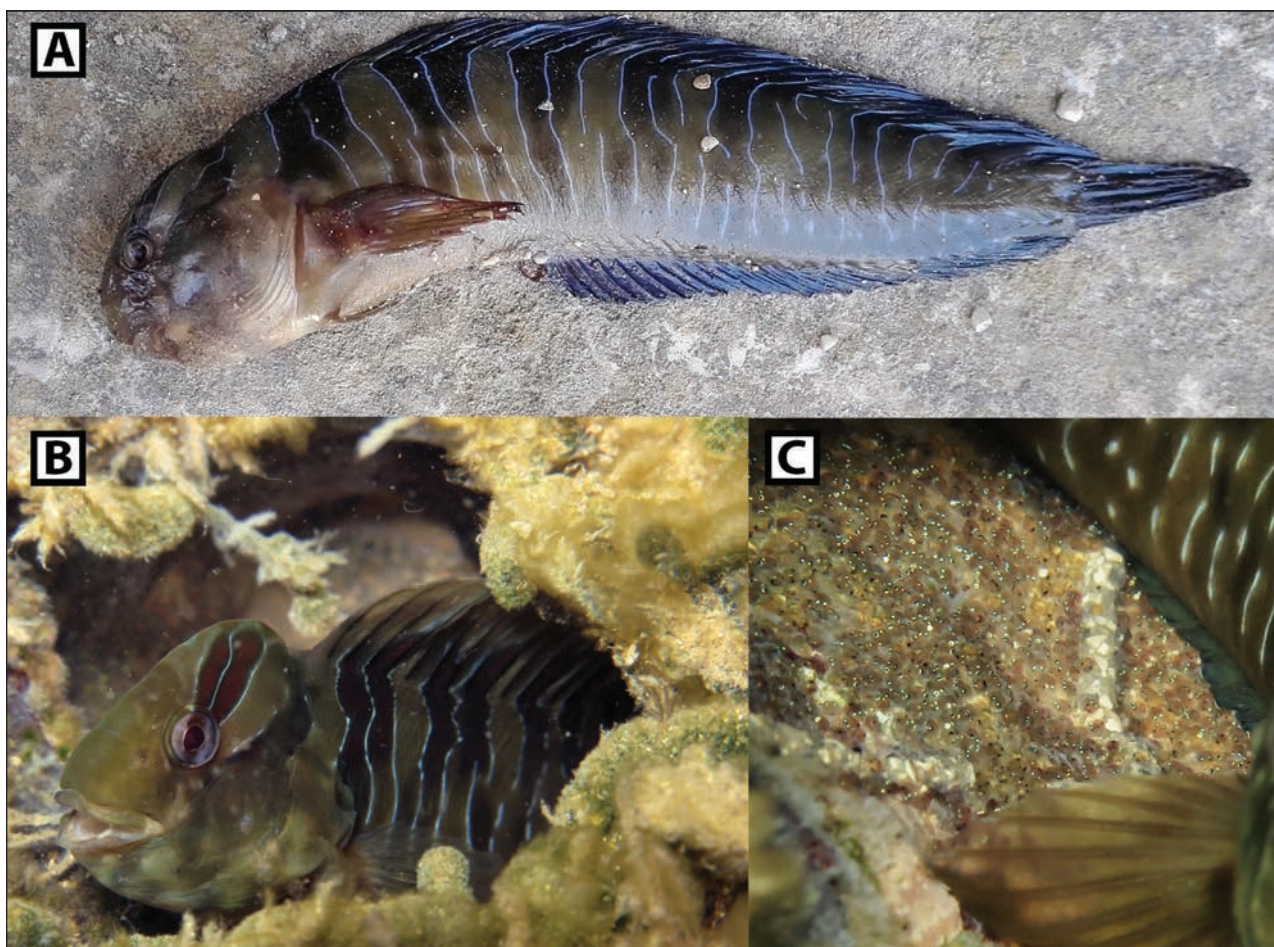


Fig. 2: Specimen of *S. basilisca* found in Marsala on 17 July 2022 (A); male of *S. basilisca* defending the nest, observed in Marsala on 13 August 2023 (B); eggs of *S. basilisca* (C).

Sl. 2: Primerek vrste *S. basilisca* najden v Marsali 17. julija 2022 (A); samec zebraste babice brani gnezdo, opazovano v Marsali 13. avgusta 2023 (B); jajca vrste *S. basilisca* (C).

In conclusion, this paper provides the first thoroughly documented record of the “enigmatic” blenny species *S. basilisca* from Sicilian waters and the first report of a stable population of this species in the area. It also presents an additional record from a new location in Sardinia (Caprera Island), which is currently the Italian region where the studied species is most abundantly and widely distributed. Last but not least, the paper documents for the first time certain behavioural traits of the species in its habitat, providing new data on the biology and ecology of this little-known and understudied species. Further research focused on areas with stable populations of *S. basilisca*, such as Marsala, is of great relevance for improving our understanding of the biological and ecological aspects of this fish. Furthermore, considering the close association between the species and seagrasses, the decline of meadows of *P. oceanica* (and other seagrass species) could result in the local extinction of the species. This is exemplified by areas where a significant regression of *P. oceanica* has been recorded (Blanco-Murillo *et al.*, 2022).

Hence, there is an urgent need to protect high-diversity habitats such as *P. oceanica* meadows in order to prevent biodiversity loss.

Finally, as highlighted by this research, the collaboration between citizen scientists and researchers is vital in studying the biology and ecology of species. This synergy significantly broadens the range of investigations, engaging a wider network of observers and contributing to the collection of more comprehensive and detailed data on the behaviour, distribution, and ecology of the species under study (Tiralongo *et al.*, 2019; Azzurro & Tiralongo, 2020). Such an inclusive approach not only enhances scientific knowledge but also promotes public awareness and active participation in biodiversity conservation.

ACKNOWLEDGEMENTS

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SALARIA BASILISCA (ACTINOPTERYGII: BLENNIIDAE) V SREDOZEMSKIH VODAH:
NOVI BIOLOŠKI IN EKOLOŠKI PODATKI NA PODLAGI SODELOVANJA MED
LJUBITELJSKIMI RAZISKOVALCI IN RAZISKOVALCI

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POVZETEK

Zebrasta babica (*Salaria basilisca*) je endemična babica (družina *Blenniidae*) v Sredozemskem morju. Naše poznavanje o biologiji in ekologiji te vrste je omejeno, saj obstaja le nekaj razpršenih podatkov o njeni številčnosti in razširjenosti. Avtorja predstavljata prvo tarčno raziskavo z namenom dopolniti poznavanje o vrsti *S. basilisca* z novimi podatki, pridobljenimi z raziskavo stabilne populacije te vrste, odkrite na Siciliji. Več parov, ki so varovali gnezda, so opazovali avgusta 2022 pri Marsali (jugozahodna Sicilija). Vrsta naseljuje plitve predele morskega dna, pokritega z morsko travo, njena prostorska razširjenost pa se razlikuje med dnevnimi in nočnimi urami. Prispevek obenem poudarja pomen sodelovanja med ljubiteljskimi naravoslovci in naravoslovnimi strokovnjaki, saj so bili nekateri od podatkov zbrani s pomočjo ljubiteljske znanosti.

Ključne besede: prave babice, Sredozemsko morje, kriptobentoške ribe, ljubiteljska znanost, redke vrste

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