DOI: 10.2478/cjf-2026-0009

CODEN RIBAEG ISSN 1330-061X (print)
1848-0586 (online)

sciendo

NEW DISTRIBUTIONAL RECORDS OF THE ENDEMIC MOROCCAN BLENNY *Salariopsis atlantica* (Doadrio, Perea & Yahyaoui, 2011)

Soufyane El Caidi[1], Abdelkhaleq Fouzi Taybi[2], Youness Mabrouki[1*]

[1] *Biotechnology, Conservation and Development of Bioresources Laboratory, Faculty of Sciences Dhar El Mehraz, University Sidi Mohamed Ben Abdellah, Fez, Morocco*

[2] *Laboratory for Agricultural Production Improvement, Biotechnology and Environment (LAPABE). Biodiversity and Ecology of Natural Systems Team. Mohammed Premier University, Oujda, Morocco*

*Corresponding Author: youness.mabrouki@usmba.ac.ma

ARTICLE INFO

Received: 15 August 2025
Accepted: 4 March 2026

Keywords:
Rare fish species
Sebou Basin
Invasive species
Freshwater fish
Conservation

ABSTRACT

Within Northern Africa, Morocco is distinguished by its remarkable diversity of freshwater fish species. This diversity is characterised by a high level of endemism, which is largely due to the country's unique geographical location and the complexity of its hydrographic network. *Salariopsis atlantica* (Doadrio, Perea & Yahyaoui, 2011) is an endangered (EN) Moroccan endemic species, historically confined to the Sebou Basin, where it is known from only a few locations. This study reports new populations of the Moroccan blenny further upstream on the Ouargha River, notably at Ghdir Hamma, as well as downstream from Asfalou Reservoir. This expands the species' known range, which is a key to promoting its conservation. These newly discovered populations are reported from habitats heavily impacted by increasing anthropogenic pressures and invasive alien species. This highlights the need for targeted conservation strategies integrating local threat management, habitat restoration, and exotic species control to ensure the sustainability of this rare species.

How to Cite

El Caidi, S., Taybi, A.F., Mabrouki, Y. (2026): New distributional records of the endemic Moroccan blenny *Salariopsis atlantica* (Doadrio, Perea & Yahyaoui, 2011). Croatian Journal of Fisheries, 84, 91-98. DOI: 10.2478/cjf-2026-0009.

INTRODUCTION

Morocco's geographical position at the crossroads between the Atlantic Ocean to the west and the Mediterranean Sea to the north, combined with the diversity of its landscapes and the importance of its hydrographic network, contributes significantly to the richness and endemism of its fish fauna. The country possesses the most developed inland water network in North Africa, mainly fed by water originating from the Atlas and Rif mountain ranges (Azeroual et al., 2000; Chillasse et al., 2001; Keltoum, 2022). Consequently, the freshwater fish fauna of Morocco is richer and more diverse than that of other North African countries (Pellegrin, 1921; Azeroual, 2003). The Moroccan freshwater ichthyofauna is characterised by a high level of endemism. For instance, it includes the only representative of the family Cobitidae in North Africa (Ford et al., 2020).

The family Blenniidae comprises 402 species of small marine fishes that primarily inhabit coastal ecosystems (Froese and Pauly, 2025). Some species are also capable of inhabiting estuarine and riverine environments. They are oviparous, and the male guards the eggs after spawning (Paugy et al., 2003; Froese and Pauly, 2025). Their bodies are elongated, slimy and scaleless. They possess large heads with short snouts and mouths lined with strong teeth. The dorsal fin is long and continuous, the anal fin is similarly elongated, and the caudal fin is rounded or truncated. Tentacles or filaments on the head serve as important diagnostic characters for distinguishing species (Paugy et al., 2003).

Recent taxonomic and phylogenetic studies have led to a revision of the genus *Salaria* Forsskål, 1775, resulting in the reclassification of several species previously included within this genus. These species have been assigned to a new genus, *Salariopsis* Vecchioni, Ching, Marrone, Arculeo, Hundt and Simons, 2022, which was established and based on both morphological and molecular evidence. The new genus is characterised by fewer soft dorsal and anal rays than species of the genus *Salaria* (Vecchioni et al., 2022). This recently described genus currently comprises five species: *Salariopsis atlantica* (Doadrio, Perea and Yahyaoui, 2011); *S. economidisi* Kottelat, 2004; *S. fluviatilis* (Asso, 1801); *S. renatorum* Yoğurtçuoğlu et al., 2023 and *S. burcuae* Yoğurtçuoğlu et al., 2023 (Yoğurtçuoğlu et al., 2023; Froese and Pauly, 2025).

The Moroccan blenny *Salariopsis atlantica* is an extremely rare endemic species restricted to Morocco. Its distribution is confined to a small area within the Sebou River Basin. According to the IUCN Red List, the species is classified as Endangered (EN) (Doadrio et al., 2011). This study provides new records and additional information on this species, which has received limited scientific attention to date and for which further data are essential for conservation purposes.

MATERIALS AND METHODS

Specimens of *S. atlantica* were captured as part of routine hydrobiological and monitoring studies on the presence and impact of invasive species in Morocco, which we have been conducting since 2014. Field surveys were carried out in different regions of the country, mainly in northern Morocco, including the Moulouya Basin, the Middle Atlas Mountains and the Sebou Basin (Fig. 1).

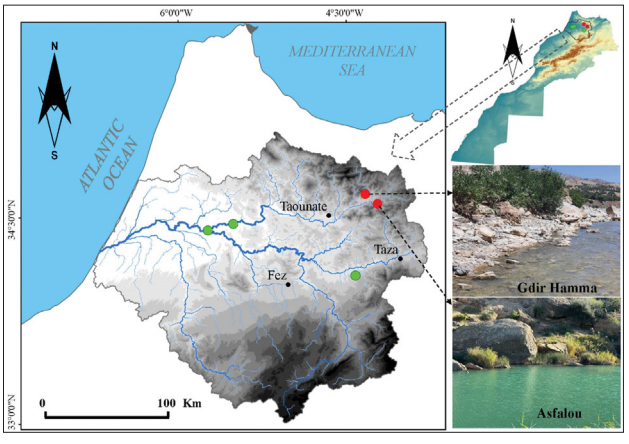

Fig 1. Distribution of *Salariopsis atlantica* in Morocco, showing new records in red and previously known records in green (from Doadrio et al., 2011; IUCN 2022; iNaturalist 2025)

Fish were collected using a triangular landing net consisting of a 40 cm wide metal frame equipped with a fine mesh net (3 mm mesh size), suitable for capturing small species. Additionally, a cylindrical trap with guiding wings (eel trap) was used. The device, equipped with a non-return funnel, measures 1 m in length and 30 cm in diameter. The guiding wings are 120 cm long and 50 cm high, and the mesh size is 2 mm.

Sampling lasted approximately one hour over an area of 10 m² at each station. Native fish were returned to the water after being measured (see Taybi et al., 2020 for further details). Two reference specimens of *S. atlantica* were preserved in 90% ethanol solution and deposited at Sidi Mohamed Ben Abdellah University in Fez, Morocco (catalogue numbers: SA-SE:1and2).

Salinity, pH, dissolved oxygen and water temperature were measured in situ using a multiparameter probe (WTW, MultiLine P4). The total length (TL) of specimens was measured to the nearest 0.1 mm, and the total body weight (W) was recorded to the nearest 0.01 g. Measurements were taken in situ using a digital calliper and an electronic balance.

Fish sampling for the present study was conducted in accordance with Moroccan legislation and was approved by Sidi Mohammed Ben Abdellah University, Faculty of Sciences Dhar El Mahraz (Fez, Morocco).

RESULTS

New populations of the Moroccan blenny *Salariopsis atlantica* were discovered further upstream in the Ouargha River Basin, specifically in areas known as Ghdir Hamma and Asfalou. These locations are more than 160 km upstream from the previously known occurrence of the species.

At these new sites, populations of *S. atlantica* coexist with other native fish species, including *Carasobarbus fritschii* (Günther, 1874) and *Luciobarbus maghrebensis* Doadrio, Perea and Yahyaoui, 2015. Invasive fish species were also detected at the sampling sites, namely *Gambusia holbrooki* Girard, 1859 and *Lepomis gibbosus* (Linnaeus, 1758).

During the sampling period, water temperature at both stations ranged between 21 and 25 °C. Dissolved oxygen concentrations ranged from 8.28 to 11 $mg \cdot L^{-1}$, pH values ranged from 7.13 to 7.5, and electrical conductivity ranged from 647 to 1000 $\mu S \cdot cm^{-1}$ (Table 1). These sites are subject to significant anthropogenic pressure related to tourist activities, including trampling of riverbanks, local pollution and disturbance of springs.

All specimens exhibited the same morphotype. The size and weight of the collected individuals ranged from 5.8 to 6.1 cm (total length measured to the tip of the caudal fin) and from 1.89 to 2.25 g. The body is rounded anteriorly, and becomes laterally compressed towards the caudal region, resulting in a fusiform body shape (Fig. 2).

The examined individuals possessed 12 spiny rays and 16 soft rays in the dorsal fin, as well as 2 spiny rays and 16 soft rays in the anal fin, which is consistent with values reported for *Salariopsis atlantica* and partially overlaps with those of closely related species. Diagnostic characteristics are mainly based on cephalic features and colouration.

The studied specimens display a thick single supraocular tentacle, 3 supratemporal canal pores, 8 circumorbital canal pores and 7 preopercular canal pores, which correspond to the original description of *S. atlantica*. The absence of rows of black dots on the cheeks, combined with the presence of blue cephalic pores and bluish spots in the gular region, allows *S. fluviatilis* and *S. economidisi* to be excluded. All of these characteristics (Table 2, Figs. 2 and 3) confirm the identification of the specimens as *S. atlantica*, in accordance with the descriptions provided by Doadrio et al. (2011) and Vecchioni et al. (2022).

Table 1. Sampling locations and mean values of physicochemical water parameters at the study sites where *Salariopsis atlantica* was found

Location	GPS	Sampling date	Number of individuals	pH	Electrical conductivity ($\mu S \cdot cm^{-1}$)	Dissolved oxygen ($mg \cdot L^{-1}$)	Temperature (°C)
Asfalou	34°37'41.5"N 4°11'27.5"W	13/07/2024	11	7.5 ± 0.09	647 ± 13	11 ± 0.1	21± 05
Ghdir Hamma	34°42'03.0"N 4°17'49.0"W	30/07/2025	8	7.13 ± 0.03	1000 ± 25	8.28 ± 0.08	25 ± 0.7

Table 2. Morphological data of *Salariopsis atlantica* specimens collected from the study sites. Diagnostic characters of *S. atlantica, S. economidisi* and *S. fluviatilis*. Dorsal-fin rays (D), anal-fin rays (A), caudal-fin rays (C), cephalic pores of the supratemporal canal (Cpstc), cephalic pores of the preopercular canal (Cppoc), cephalic pores of the circumorbital canal (Cpcoc) and supraocular tentacle (Sot). Superscripts indicate source: *a* Kottelat (2004), *b* Doadrio et al. (2011), and *c* Tiralongo (2020).

Diagnostic characters	Specimens of *S. atlantica* collected from the study sites	*S. atlantica*	*S. fluviatilis*	*S. economidisi*
D	XII 16	XII-XIII 16-17 [b]	XII-XIII 16-17 [c]	XII-XIII 16-17 [a]
A	II 16	II 16-17 [b]	II 16-19 [b]	II 16-19 [b]
C	7	-	-	-
Cpstc	3	3 [b]	-	-
Cppoc	7	7-9 [b]	9-10 [b]	10-11 [b]
Cpcoc	8	8-9 [b]	8 [b]	8 [b]
Sot	Thick and simple	Thick and simple [b]	Branched [b]	Simple [b]

Fig 2. Specimens of *Salariopsis atlantica* collected from the study sites

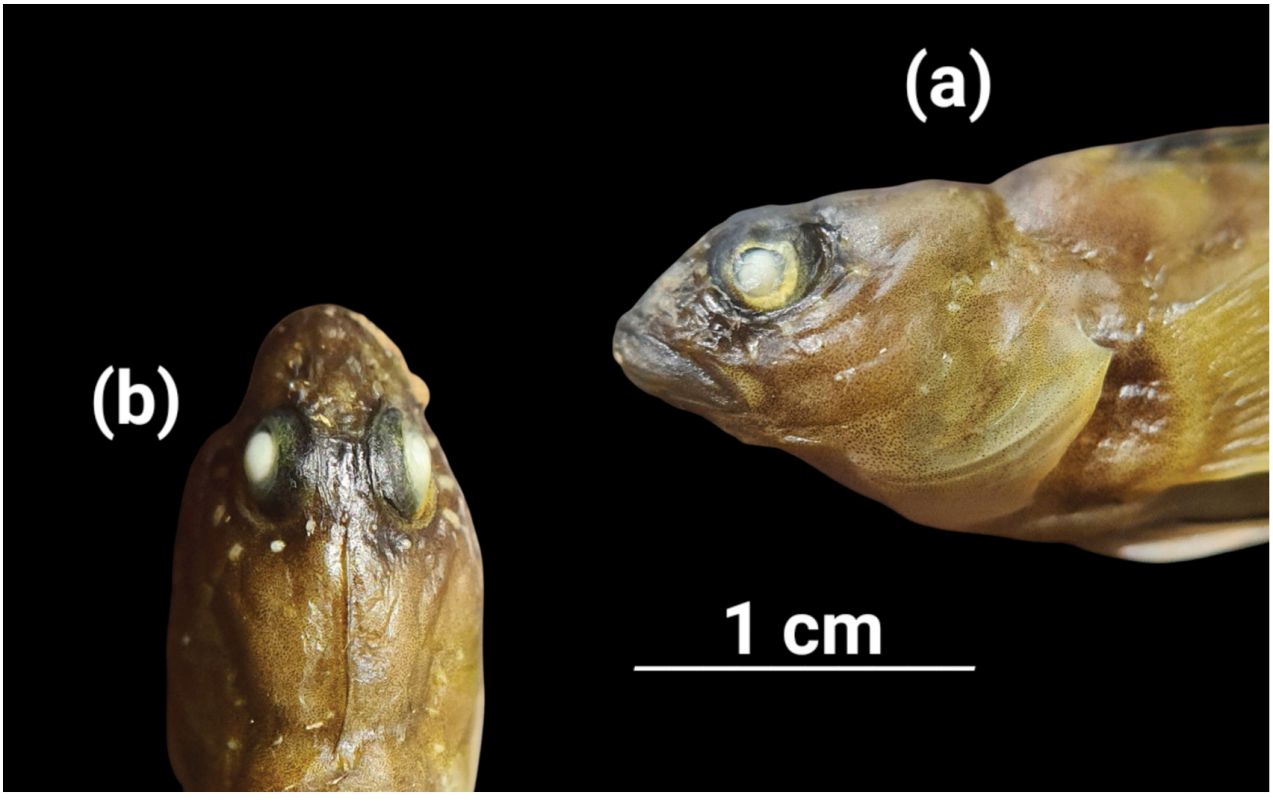

Fig 3. Head of a reference specimen of *S. atlantica*: (a) lateral view; (b) dorsal view

DISCUSSION

This study provides new information and distributional records of the endangered Moroccan endemic species *S. atlantica*, significantly expanding its known distribution range. The distribution of *S. atlantica* is restricted to the Oued Bouhlou River and the Ouargha River sub-watershed, making it endemic to the Sebou River Basin in Morocco (Doadrio et al., 2011; IUCN, 2022).

Salariopsis atlantica remains a poorly studied and rarely reported freshwater fish species. Until recently, it was mainly known from the lower reaches of the Ouargha River. However, the present study revealed new upstream locations where large populations were observed, including Ghdir Hamma and downstream of the Asfalou Reservoir. Nevertheless, these sites are exposed to increasing tourist pressure, which represents a potential threat to this fragile habitat by altering water quality and compromising ecological conditions essential for the survival of the species.

Due to the various threats affecting its entire range, *S. atlantica* is listed as Endangered (EN) on the IUCN Red List (IUCN, 2022). The Sebou River Basin is recognised as one of the most polluted hydrological systems in Morocco. The main sources of pollution include urban and agricultural wastewater discharges, intensive agricultural activities and drainage water from the watershed (Kaioua et al., 2022).

Along the Ouargha River, activities such as pesticide use, discharge of olive-mill waste and vehicle washing may seriously threaten *S. atlantica* and aquatic biodiversity in general. The release of industrial oils and wastewater can lead to liver damage, increased neurotoxicity and locomotor disorders in fish (Péan, 2012; Laurent, 2023). Hydrocarbons can directly affect aquatic organisms by causing physical injuries such as irritation and burns, and they may also have toxic effects on the reproduction and development of aquatic species (Zeghouati et al., 2024).

Climate change also directly affects the reproductive phenology of species, primarily through changes in temperature and hydrological regimes (Moussa et al., 2022; Laurent, 2023). It may reduce distribution ranges through the progressive drying of aquatic ecosystems, thereby rendering certain habitats unsuitable for species survival (Gamboa, 2011).

Morocco is currently experiencing a prolonged drought lasting more than six years, which has severely depleted available water resources. This situation has resulted in a significant decline in river discharge and the partial drying of groundwater resources, affecting sensitive species such as *S. atlantica* and *Cobitis maroccana* Pellegrin, 1929.

Another significant threat is biological invasion, which represents a major global environmental issue. Invasive species are responsible for considerable losses in biodiversity and ecosystem services (Dgebuadze et al., 2018; Haubrock et al., 2021; Mabrouki et al., 2025a). The Sebou Basin has recorded the highest number of exotic species introductions in Morocco (Taybi et al., 2023).

Nearly half of these introductions to freshwater ecosystems were intentional, mainly through fish stocking programmes involving exotic fish. These introductions are also associated with the aquarium trade and the commerce of ornamental plants and animals (Taybi et al., 2023, 2024; Mabrouki et al., 2023a, b, 2025b).

Highly invasive fish species such as *Poecilia reticulata* Peters, 1859, *Carassius auratus* (Linnaeus, 1758), *Gambusia holbrooki* Girard, 1859 and *Xiphophorus hellerii* Heckel, 1848 are confirmed to occur in Morocco's inland waters (Mabrouki et al., 2020; Taybi et al., 2023; El Caidi et al., 2025a, b, c). These species may contribute to the decline of native populations through predation, competition or the transmission of diseases and parasites (Brewer et al., 1999; Gozlan et al., 2005; Hassan et al., 2008; Peeler et al., 2011; Portilla et al., 2023).

An example is the Asian anchor worm *Lernaea cyprinacea* Linnaeus, 1758, which parasitises two endemic species in the Sebou Basin, namely *Carasobarbus fritschii* (Günther, 1874) and *Cobitis maroccana* (Pellegrin, 1929) (El Caidi et al., 2025b).

CONCLUSION

Salariopsis atlantica is an endangered endemic species with a very restricted distribution range, making it particularly vulnerable to environmental disturbances. Prolonged drought, aquatic pollution and the introduction of invasive alien species represent major pressures that could lead to a significant decline in its populations or even to its extinction if appropriate conservation measures are not implemented.

The discovery of new populations highlights the importance of strengthening monitoring and conservation efforts. Establishing a regular monitoring programme is essential for assessing population dynamics, demographic structure and long-term viability.

Furthermore, reducing anthropogenic pressures, particularly habitat degradation, pollution and the introduction of invasive species, must be prioritised.

Close collaboration among scientists, conservation experts and ecosystem managers is therefore essential to develop and implement appropriate management strategies. The preservation of aquatic ecosystems and the sustainable management of water resources are key factors for ensuring the long-term conservation of this vulnerable species.

NOVI PODACI O RASPROSTRANJENOSTI ENDEMSKE MAROKANSKE RIBLJE VRSTE *Salariopsis atlantica* (Doadrio, Perea & Yahyaoui, 2011)

SAŽETAK

Unutar sjeverne Afrike, Maroko se odlikuje izvanrednom raznolikošću slatkovodnih vrsta riba. Ovu raznolikost karakterizira visoka razina endemizma, što se uvelike može pripisati jedinstvenom geografskom položaju i složenosti njezine hidrografske mreže u zemlji. *Salariopsis atlantica* (Doadrio, Perea & Yahyaoui, 2011) je ugrožena (EN) marokanska endemska vrsta, povijesno ograničena na bazen Sebou, gdje je utvrđena na samo nekoliko lokaliteta. Ova studija daje podatke o novim populacijama ove vrste dalje uzvodno na rijeci Ouargha, posebno kod Ghdir Hamme, kao i nizvodno od akumulacijskog jezera Asfalou. To proširuje poznati raspon vrste, što je ključno za promicanje njezinog očuvanja. Ove novootkrivene populacije zabilježene su u područjima koja su snažno pogođena sve većim antropogenim pritiscima i invazivnim stranim vrstama. To naglašava potrebu za ciljanim strategijama očuvanja koje integriraju lokalno upravljanje prijetnjama, obnovu staništa i kontrolu novih vrsta kako bi se osigurala održivost ove rijetke vrste.

Ključne riječi: rijetke riblje vrste, sliv Sebou, invazivne vrste, slatkovodne ribe, očuvanje

ACKNOWLEDGMENTS

We would like to express our sincere gratitude to the Editor and the Reviewers for their helpful and constructive comments, which have greatly improved the manuscript. We also thank Professor Mediouni Abdeljabbar for revising the English in this manuscript.

CONFLICT OF INTEREST

The author declares no conflict of interest.

DATA AVAILABILITY STATEMENT

The datasets generated and/or analysed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

REFERENCES

Azeroual, A., Crivelli, A. J., Yahyaoui, A., Dakki, M. (2000): L'ichtyofaune des eaux continentales du Maroc. Cybium, 24, 17 – 22.

Azeroual, A. (2003): Monographie des poissons des eaux continentales du Maroc: systématique, distribution et écologie. Ph. D Thesis, Université Mohammed V-Agdal, Rabat, Morocco.

Brewer, M., Dawidowicz, P., Dodson, S. (1999): Interactive effects of fish kairomone and light on Daphnia escape behavior. Journal of Plankton Research, 2, 1317–1335. https://doi.org/10.1093/plankt/21.7.1317

Chillasse, L., Dakki, M., Abbassi, M. (2001): Valeurs et fonctions écologiques des Zones humides du Moyen Atlas (Maroc). Humedales Mediterráneos, 1, 139 – 146

Dgebuadze, Y. Y., Petrosyan, V. G., Khlyap, L. A. (2018): Samye opasnye invazionnye vidy Rossii (TOP-100) (The most dangerous invasive species of Russia (Top-100)), Moscow: KMK Scientific Press, 688 pp.

Doadrio, I., Perea, S., Yahyaoui, A. (2011): Morphological and molecular analyses of freshwater blennids: a new species of the genus *Salaria*, Forsskål 1775 (Actinopterygii, Blennidae) in Morocco. Graellsia, 67, 151–173.

El Caidi, S., Taybi, A. F., Mabrouki, Y. (2025a): Re-discovery of the invasive guppy *Poecilia reticulata* (Peters, 1859) (Poeciliidae) in Morocco. Natura Croatica, 34(1),111–118. https://doi.org/10.20302/NC.2025.34.6

El Caidi, S., Taybi, A. F., Mabrouki, Y. (2025b): New hosts and records of the alien asian anchor worm *Lernaea cyprinacea* Linnaeus, 1758 (Crustacea: Copepoda) in Morocco. Russian Journal of Biological Invasions, 16(2), 297–303. https://doi.org/10.1134/S2075111725700134

El Caidi, S., Taybi, A. F., Mabrouki, Y. (2025c): The invasive goldfish *Carassius auratus* (Linnaeus, 1758) (Cyprinidae, Actinopterygii) is spreading in freshwater ecosystems of Morocco through aquarium trade. Povolzhskii Ekologicheskii Zhurnal, 2025(3), 365 – 373. https://doi.org/10.35885/1684-7318-2025-3-365-37

Ford, M., Brahimi, A., Baikeche, L., Bergner, L., Clavero, M., Doadrio, I., Lopes-Lima, M., Perea, S., Yahyaoui, A., Freyhof, J. (2020): Freshwater fish distribution in the Maghreb, a call to contribute. OSF Preprints. https://doi.org/10.31219/osf.io/kx4gc

Froese, R., Pauly, D. (Eds.). (2025). Family Blenniidae – Combtooth blennies. In FishBase. Retrieved 2025-08-02, from https://fishbase.se/Summary/FamilySummary.php?ID=392

Gamboa, B. (2011): Impacts des changements climatiques sur la distribution des poissons d'eau douce en France métropolitaine. Rapport de stage, Université Paul Sabatier Toulouse III.

Gozlan, R. E., St-Hilaire, S., Feist, S. W., Martin, P., Kent, M. L. (2005): Disease threat to European fish, Nature, 435(7045), 1046.

Hassan, M., Beatty, S. J., Morgan, D. L., Doupé, R. G., Lymbery, A. J. (2008): An introduced parasite, *Lernaea cyprinacea* L., found on native freshwater fishes in the south west of Western Australia. Journal of the Royal Society of Western Australia, 91, 149–153.

Haubrock, P. J., Turbelin, A. J., Cuthbert, R. N. et al. (2021): Economic costs of invasive alien species across Europe. NeoBiota, 67, 153. https://doi.org/10.3897/neobiota.67.58196

iNaturalist contributors, iNaturalist. (2025): iNaturalist Research-grade Observations. iNaturalist.org. Occurrence dataset https://doi.org/10.15468/ab3s5x accessed via GBIF.org on 2025-08-02. iNaturalist contributors (2025): iNaturalist Research-grade Observations. iNaturalist.org. Occurrence dataset https://doi.org/10.15468/ab3s5x. accessed via GBIF.org on 2025-08-02; https://www.gbif.org/occurrence/5154826802

IUCN (2022). The conservation status of freshwater species and habitats in Key biodiversity areas at the Sebou river basin. Gland, Switzerland: IUCN.

Laurent, J. (2023): Ecologie du stress et qualité écologique de l'estuaire de la Seine et des fleuves côtiers bretons: signatures environnementales et moléculaires chez une espèce sentinelle, le Flet (*Platichthys flesus*). PhD Thesis,. Bretagne occidentale University, Brest, France.

Kaioua, S., Houzi, G., Alaizari, H., El Harrak, L., El Harche, H., Fadli, M. (2022): Physico-chemical characterization, pollution and typology of water sebou river estuary. Egyptian Journal of Aquatic Biology & Fisheries, 26(3).

Keltoum, O. (2022): Diversité génétique mitochondriale, phylogéographie et histoire démographique des poissons indigènes des eaux continentales du Maroc: Cas des genres *Luciobarbus, Cobitis* et *Coptodon*. PhD Thesis, Mohammed V-Agdal University, Rabat, Morocco.

Kottelat, M. (2004): *Salaria economidisi*, a new species of freshwater fish from Lake Trichonis, Greece, with comments on variation in *S. fluviatilis* (Teleostei: Blenniidae). Revue Suisse de Zoologie, 111(1), 121–137.

Mabrouki, Y., Taybi, A. F., Bahhou, J., Doadrio, I. (2020): The first record of the green swordtail *Xiphophorus helleri* (Miller, 1966) (Poeciliidae) established in the wild from Morocco. Journal of Applied Ichthyology, 36(6), 795–800. https://doi.org/10.1111/jai.14105

Mabrouki, Y., Taybi, A. F., Glöer, P. (2023a): The first record of the North American freshwater limpet *Ferrissia californica* (Mollusca, Gastropoda) in Morocco. Nature Conservation Research, 8(1), 108–112. https://doi.org/10.24189/ncr.2023.004

Mabrouki, Y., Taybi, A. F., Vila-Farré, M. (2023b): First record of the globally invasive planarian *Girardia tigrina* (Girard, 1850) sensu lato in Morocco. Bioinvasion Records, 12(1), 257–264. https://doi.org/10.3391/bir.2023.12.1.21

Mabrouki, Y., Gourari, K., Taybi, F. A. (2025a): The Atlantic blue crab *Callinectes sapidus* Rathbun, 1896 (Portunidae, Malacostraca) could lead to the local extinction of endemic freshwater species in Eastern Morocco). Povolzhskii Ekologicheskii Zhurnal, 1, 91–99. https://doi.org/10.35885/1684-7318-2025-1-91-99

Mabrouki, Y., Taybi, F. A., Shrestkha, M., Sidorovskyi, S., Utevsky, A., Utevsky, S. (2025b): Do Wild and Aquacultural Alien Leeches of the Genus *Barbronia* (Hirudinea: Salifidae) Belong to *Barbronia weberi*? Evidence from Morocco and Ukraine. Ecologica Montenegrina, 84, 161–173. https://doi.org/10.37828/em.2025.84.12

Moussa, B. Y., Mousa, Y., Saqalli, M., Laffly, D., Chapron, E. (2022): Pratiques de pêche de poissons et changement climatique sur le fleuve Niger à Niamey, Niger. Afrique Science: revue internationale des sciences et technologies, 21(3), 142–156.

Paugy O., Lévêque C., Teugels G. G. (2003): Poissons d'eaux douces et saumâtres de l'Afrique de l'Ouest. IRD Editions Paris, MNHN Paris, MRAC Tervuren, Faune et Flore tropicales, 40(1), 457 pp.

Péan, S. (2012): Effets des polluants organiques persistants sur le comportement des poissons. Sciences agricoles. Université de La Rochelle. Français. (NNT : 2012LAROS359).

Peeler, E. J., Oidtmann, B. C., Midtlyng, P. J., Miossec, L., Gozlan, R. E. (2011): Non-native aquatic animals introductions have driven disease emergence in Europe, Biological Invasions, 13(6), 1291–1303. https://doi.org/10.1007/s10530-010-9890-9

Pellegrin, J. (1921): Les poissons des eaux douces de l'Afrique du Nord française (Maroc, Algérie, Tunisie, Sahara). Mémoires de la Société des sciences naturelles du Maroc, 1(2), 1–217.

Portilla, K., Velarde, E., Oña, T., Decaestecker, E., Teixeira De Mello, F., Muylaert, K. (2023): Effects of the invasive fish *Poecilia reticulata* on the behavioral response of *Daphnia pulex* to the exotic submerged macrophyte *Egeria densa*. Hydrobiologia, 851(5), 1183–1201. https://doi.org/10.1007/s10750-023-05377-2

Taybi, A. F., Mabrouki, Y., Doadrio, I. (2020): The occurrence, distribution and biology of invasive fish species in fresh and brackish water bodies of NE Morocco. Arxius de Miscellania Zoologica, 18, 59–73. https://doi.org/10.32800/amz.2020.18.0059

Taybi, A. F., Mabrouki, Y., Christophe, P. (2023): Distribution of freshwater alien animal species in Morocco: current knowledge and management issues. Diversity, 15(2), 169. https://doi.org/10.3390/d15020169

Taybi, A. F., Mabrouki, Y., Glöer, P., Piscart, C. (2024): Factors explaining the distribution of *Physella acuta* (Draparnaud, 1805) in freshwaters of Morocco. Water, 16, 803. https://doi.org/10.3390/w16060803

Tiralongo, F. (2020). Blennies of the Mediterranean Sea: Biology and identification of Blenniidae, Clinidae and Tripterygiidae. Amazon Distribution, Leipzig, Germany, pp. 131.

Vecchioni, L., Ching, A. C., Marrone, F., Arculeo, M., Hundt, J. P., Simons, A. M. (2022): Multi-locus phylogenetic analyses of the Almadablennius clade reveals inconsistencies with the present taxonomy of blenniid fishes. Diversity, 14(1), 53. https://doi.org/10.3390/d14010053

Zeghouati, D., Hadjed, S. (2024): La pollution de la mer Méditerranée par les hydrocarbures. Impact sur la faune et flore marine. Ph. D Thesis, Tizi Ouzou: Université Mouloud Mammeri.

Yoğurtçuoğlu, B., Cüneyt, K., Atalay, M. A., Ekmekçi, F. G., Freyhof, J. (2023): Two new freshwater blennies from the Eastern Mediterranean basin (Teleostei: Blenniidae). Zootaxa, 5311(1), 85–104.