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UNEXPECTED OCCURRENCE OF PRUSSIAN CARP *CARASSIUS GIBELIO* (CYPRINIDAE) IN HOMA LAGOON (IZMIR BAY, AEGEAN SEA)

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ABSTRACT

On 24 February 2026, a female specimen of Carassius gibelio *was caught using a trammel net targeting grey mullets in Homa Lagoon, located on the coast of Izmir Bay, at a depth of 1 m. Homa is a highly saline environment, with salinity values ranging from 35.6 ‰ to 63.7 ‰. Therefore, the occurrence of* C. gibelio*, a potamodromous fish species, in its waters represents an unexpected phenomenon. This paper not only presents a remarkable occurrence of this invasive species in an unusual habitat, but also provides an additional contribution to the fish fauna records of Homa Lagoon, Izmir Bay.*

Key words: Salty lagoon, unusual habitat, measurement, Mediterranean

OCCORRENZA INASPETTATA DELLA CARPA DI PRUSSIA *CARASSIUS GIBELIO* (CYPRINIDAE) NELLA LAGUNA DI HOMA (BAIA DI IZMIR, MAR EGEO)

SINTESI

Il 24 febbraio 2026, un esemplare femmina di Carassius gibelio *è stato catturato mediante una rete da imbrocco utilizzata per la pesca dei cefali grigi nella laguna di Homa, situata sulla costa della Baia di Izmir, a una profondità di 1 m. Homa è un ambiente altamente salino, con valori di salinità compresi tra 35,6 ‰ e 63,7 ‰. Pertanto, la presenza di* C. gibelio*, una specie ittica potamodroma, nelle sue acque rappresenta un fenomeno inatteso. Questo lavoro non solo documenta una notevole presenza di questa specie invasiva in un habitat insolito, ma fornisce anche un ulteriore contributo ai dati sulla fauna ittica della laguna di Homa, nella Baia di Izmir.*

Parole chiave: laguna salata, habitat insolito, misurazione, Mediterraneo

INTRODUCTION

Cypriniformes are among the most evolutionarily successful freshwater fish, characterized by wide distribution, high abundance, and remarkable species diversity. This paper focuses on the Prussian carp *Carassius gibelio* (Bloch, 1782), as this species still retains a strong ability to colonize new areas and is well known for invading diverse water bodies (Afanasyev *et al.*, 2025). Nowadays, *C. gibelio* has attracted considerable interest from aquatic biologists. It is an invasive species with a widespread distribution resulting from introductions and translocations across most European countries (Perdikaris *et al.*, 2012).

Carassius gibelio inhabits a wide variety of still water bodies and lowland rivers usually associated with submerged vegetation or periodic flooding. It displays strong tolerance to low oxygen concentrations and pollution. Its diet includes plankton, benthic invertebrates, plant material, and detritus, *C. gibelio* spawns on submerged vegetation in shallow, warm shores and is capable of developing from unfertilized eggs (gynogenesis). Its life span reaches up to about 10 years. Length at maturity is 10.3 cm, the maximum total length is 46.6 cm (common total length: 20.0 cm), and the maximum published weight is 3.0 kg (Froese & Pauly, 2025).

Carassius gibelio is distributed across Europe and Asia. Clear and definite data on its native range in Europe are lacking due to historical introductions, confusion with *Carassius auratus*, and complex breeding patterns. At present, the species is widely distributed and commonly stocked together with *Cyprinus carpio*, which is transported throughout Europe. It is absent from the northern Baltic basin, Iceland, Ireland, Scotland, and Mediterranean islands (Froese & Pauly, 2025). The species has minimal commercial value, which makes it an undesirable target for fisheries (Perdikaris *et al.*, 2012).

The Prussian carp is listed by the IUCN as one of the 100 worst invasive species in the world. As vector, they were introduced to Türkiye from Europe for fish release purposes. Following its introduction, *C. gibelio* spread rapidly and uncontrollably to other lakes (Uysal & Boz, 2018). This study presents unexpected field data on this species' appearance in a new region, specifically, its first observation in a high-salinity lagoon basin in Izmir Bay, Aegean Sea.

Fig. 1: *Carassius gibelio* ***caught from Homa Lagoon (ESFM-PIS/2026-01) with a black peritoneum. Scale bar: 50 mm.***
Sl. 1: *Carassius gibelio* ***(srebrni koreselj), ujet v laguni Homa (ESFM-PIS/2026-01), s črnim peritonejem (trebušno mreno). Merilo: 50 mm.***

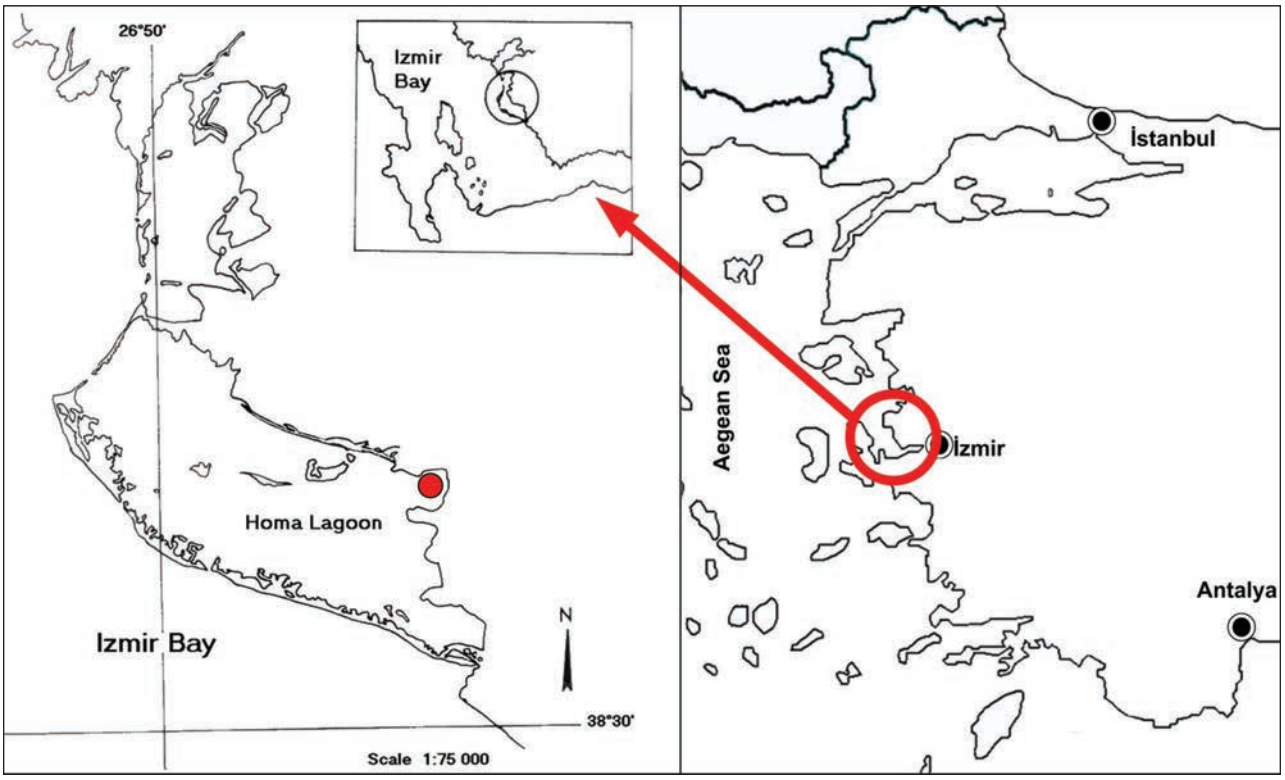

Fig. 2: Sampling site (red dot) of *Carassius gibelio* ***in Homa Lagoon, Izmir Bay, Aegean Sea.***
Sl. 2: Lokacija vzorčenja (rdeča pika) za vrsto *Carassius gibelio* ***v laguni Homa, Izmirski zaliv, Egejsko morje.***

MATERIAL AND METHODS

On 24 February 2026, a female specimen of *Carassius gibelio* (Fig. 1) was caught using a trammel net targeting grey mullets in Homa Lagoon, located on the coast of İzmir Bay (38°32′00″ N, 26°52′51″ E) at a depth of 1 m (Fig. 2).

Homa Lagoon, situated near the Gediz River delta in the northeastern part of the Izmir Bay, is an important wetland covering an area of approximately 1824 hectares and serving as a feeding, growth, and breeding area for many fish and bird species. Since 1986, the lagoon has been used as an experimental fishing area by the Faculty of Fisheries of Ege University. It has also been designated as a wildlife conservation area since 1984 and has been protected under the Ramsar Convention since 1998 (Akyol, 2005). A total of 39 fish species have been identified within the lagoon to date (Alpbaz & Kınacıgil, 1988; Acarlı *et al.*, 2009). The sample fish was fixed in 6% formaldehyde solution and preserved in the fish collection of the Faculty of Fisheries, Ege University (ESFM-PIS/2026-01). Terminology followed Soto *et al.* (2024), who evaluated the various terms used in invasion science and proposed a simplified and standardized nomenclature.

RESULTS AND DISCUSSION

The specimen was identified as a *Carassius gibelio* based on the following characters: body silvery-brown, peritoneum black; last simple anal and dorsal-fin rays strongly serrated; 29 scales along the lateral line (Fig. 1). Selected morphometric measurements and proportions expressed as percentages of total length (TL%) are presented in Table 1.

Carassius gibelio was first reported in Türkiye from Lake Gala in the 1980s (Baran & Ongan, 1988). Subsequently, the species spread to almost all inland waters of Thrace and Anatolia (Ekmekçi *et al.*, 2013). Since then, the Prussian carp has probably become the most dominant invasive non-native fish species and is now considered naturalized in more than 230 lakes, rivers, streams, ponds, and reservoirs throughout Türkiye (Ekmekçi *et al.*, 2013; Yerli *et al.*, 2014). The dominance of *C. gibelio* is attributed to its broad environmental tolerance and flexible adaptive biological strategies, including omnivorous feeding habits, exploitation of variable habitats (slow-running lotic, lentic, and transitional systems with low salinity), intense reproductive activity, and active competition for food, spawning sites, and spawning substrates (Pardikaris *et al.*, 2012). It is

Tab. 1: Morphometric measurements and proportions expressed as percentages of total length (TL%) for *Carassius gibelio* ***captured in Homa Lagoon, Izmir Bay, Aegean Sea.***
Tab. 1: Morfometrične meritve in deleži, izraženi kot odstotki celotne dolžine (TL %), za primerek vrste *Carassius gibelio****, ujetega v laguni Homa, Izmirski zaliv, Egejsko morje.***

Morphometrics	**mm**	**TL%**
Total length (TL)	255	-
Standard length (SL)	210	82.4
Head length (HL)	55	21.6
Eye diameter	11	4.3
Snout length	15	5.9
Body depth	81	31.8
Predorsal length	94	36.9
Preanal length	155	60.8
Prepectoral length	52	20.4
Meristic counts		
Dorsal fin	III + 17	
Anal fin	III + 5	
Pectoral fin	18	
Ventral fin	I + 8	
Lateral line	29	
Weight (g)	305	

therefore not surprising for the highly adaptable Prussian carps to occur in some Turkish brackish lagoons, such as Liman or Karaboğaz, Akyatan, and Peso lagoons (Ekmekçi *et al.*, 2013). These lagoons are characterized by slightly saline (brackish) waters. Liman Lagoon, which is connected to the Black Sea, has salinity levels between 0.24‰ and 13.19 ‰ (Macun, 2014). Salinity in Akyatan Lagoon in the northeastern Mediterranean region varies between 3.3‰ and 35.34‰ (average 15.64 ± 6.4‰) (Akyol & Manaşırlı, 2023). According to Akyol and Ceyhan (2010), several carp specimens accidentally caught in 2004 were recorded from Peso Lagoon (Edirne, northern Aegean Sea), where salinity dropped to 0.04‰–0.09‰ in December during the rainy season. Among these lagoons, Homa is the most saline, with values ranging from 35.6‰ to 63.7‰ (Başdemir, 2017). Perdikaris *et al.* (2012) and references therein reported that *C. gibelio* was distributed in many continental freshwaters (lotic and lentic ecosystems) as well as transitional coastal waters with low salinity. Therefore, the occurrence of *C. gibelio C. gibelio* as a potamodromous fish in the highly saline Homa Lagoon represents an unexpected phenomenon. The area where the fish was observed may have lower salinity levels compared to other parts of the lagoon due to freshwater inputs through drainage canals.

C. gibelio individuals inhabiting lakes may migrate to river estuaries during winter to avoid low dissolved oxygen conditions (Froese & Pauly, 2025). Additionally, the heavy rainfall and flooding events in January and February 2026 may have facilitated the transport of this fish to the study area. It is therefore possible that the specimen reached the estuary of the Gediz River and subsequently moved through the canals into the lagoon. A similar situation was reported from the Akçapınar Stream delta, Gökova Bay (southeastern Aegean Sea) in 2020, where a specimen of *Capoeta aydinensis* (Cyprinidae) was spotted at a depth of 1.5 m, having been transported into the marine environment during floods caused by heavy rainfall (Akyol *et al.*, 2020). Another possible explanation is foraging activity in brackish lagoons. Bohlen (1999) noted that several freshwater fishes migrate to brackish waters for feeding and growth but return to lower-salinity waters for spawning.

In conclusion, a *C. gibelio* individual, potentially displaced during flood events caused by heavy rainfall or having entered the area during foraging activity, has been recorded for the first time from an unexpected saline habitat. Therefore, this paper not only reports a remarkable occurrence of this non-indigenous species in an unusual environment, but also contributes to the fish fauna records of Homa Lagoon, Izmir Bay. Further surveys are needed to determine whether this record represents a single sporadic occurrence or a more persistent presence.

NEPRIČAKOVANI POJAV SREBRNEGA KORESLJA *CARASSIUS GIBELIO* (CYPRINIDAE) V LAGUNI HOMA (IZMIRSKI ZALIV, EGEJSKO MORJE)

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POVZETEK

*V laguni Homa na obali Izmirskega zaliva je bila 24. februarja 2026 ujeta samička srebrnega koreslja (*Carassius gibelio*). Riba je bila ujeta na globini enega metra s troslojno stojno mrežo, namenjeno lovu cipljev. Pojav je nenavaden, saj je laguna Homa izrazito slano okolje, kjer se vrednosti slanosti gibljejo med 35,6 ‰ in 63,7 ‰. Srebrni koreselj je namreč potamodromna ribja vrsta, ki je v teh vodah ne bi pričakovali. Ta članek ne prikazuje le izjemnega pojava te invazivne vrste v nenavadnem habitatu, ampak prinaša tudi dodaten prispevek k zapisom o favni rib v laguni Homa v Izmirskem zalivu.*

Ključne besede: slana laguna, nenavaden habitat, meritve, Sredozemlje

REFERENCES

Acarlı, D., A. Kara, B. Bayhan & T. Çoker **(2009):** Catch composition and catch yield of species caught from Homa Lagoon (Izmir Bay, Aegean Sea). Ege J. Fish. & Aquat. Sci., 26(1), 39–47.

Afanasyev, S., O. Gupalo, O. Lietytska, Y. Kovalenko & D. Bănăduc (2025): First record of *Carassius gibelio* (Bloch, 1782) in the upper reaches of the Tergi River (Greater Caucasus): distribution and morphological characteristics in new high-altitude conditions. BioInvasions Records, 14(4), 907–927.

Akyol, O. (2005): The Last Lagoon of Izmir Bay: Homa. Ekoloji Magazin, pp.12-16.

Akyol, O. & T. Ceyhan (2010): Fisheries in Enez Lagoon (Edirne, Northern Aegean). Ege J. Fish. & Aquat. Sci., 27(1), 31–34. (in Turkish)

Akyol, O., V. Ünal & H.M. Sarı (2020): The first report on the phenomenon of *Capoeta aydinensis* (Cyprinidae), occurring in Gökova Bay, Aegean Sea. Ege J. Fish. & Aquat. Sci., 37(4), 423–425.

Akyol, B. & M. Manaşırlı (2023): Some properties reproductive of Prussian carp, *Carassius gibelio* Bloch, 1982, in Akyatan Lagoon, Adana, Türkiye. Acta Biologica Turcica, 36(3), J8, 1–8.

Alpbaz, A. & T. Kınacıgil (1988): A study on the fish abundance and fish fauna of Homa Lagoon in İzmir. Ege J. Fish. & Aquat. Sci., 5(17–18), 31–56. (in Turkish)

Baran, I. & T. Ongan (1988): Limnological characteristics of Gala Lake, fishing problems and recommendations. Gala Gölü ve Sorunları Sempozyumu, Doğal Hayatı Koruma Derneği Bilimsel Yayınlar Serisi, İstanbul, pp. 46–54. (in Turkish)

Başdemir, D. (2017): Benthic and planktonic dinoflagellates of Homa Lagoon (Izmir Bay) and their relationships with environmental conditions. Ege Univ. Fen Bil. Enst. Ph.D. Thesis, 94 pp. (in Turkish)

Bohlen, J. (1999): Influence of salinity on the early development in the spined loach, *Cobitis taenia*. J. Fish Biol., 55, 189–198.

Ekmekçi, F.G., Ş.G. Kırankaya, L. Gençoğlu & B. Yoğurtçuoğlu (2013): Present status of invasive fishes in inland waters of Turkey and assessment of the effects of invasion. İstanbul Üniversitesi Su Ürünleri Dergisi, 28, 105–140. (in Turkish)

Froese, R. & D. Pauly (2025): FishBase. World Wide Web electronic publication. www.fishbase.org, version (11/2025).

Macun, S. (2014): Age, Growth and Sex Ratio of *Cyprinus Carpio* (Linnaeus, 1758) in a lagoon lake, Lake Karaboğaz (Samsun, Turkey). Hacettepe J. Biol. & Chem., 42 (3), 361–371.

Perdikaris, C., A. Ergolavou, E. Gouva, C. Nathanailides, A. Chantzaropoulos & I. Paschos (2012): *Carassius gibelio* in Greece: the dominant naturalised invader of freshwaters. Rev. Fish. Biol. Fisheries, 22, 17–27.

Soto, I., P. Balzani, L. Carneiro, R.N., Cuthbert, R. Macêdo, A.S. Tarkan, D.A. Ahmed, A. Bang, K. Bacela-Spychalska, S.A. Bailey, T. Baudry, L. Ballesteros-Mejia, A. Bortolus, E. Briski, J.R. Britton, M. Buřič, M. Camacho-Cervantes, C. Cano-Barbacil, D. Copilaș-Ciocianu, N.E. Coughlan, P. Courtois, Z. Csabai, T. Dalu, V. De Santis, J.W. E. Dickey, R.D. Dimarco, J. Falk-Andersson, R.D. Fernandez, M. Florencio, A.C.S. Franco, E. García-Berthou, D. Giannetto, M.M. Glavendekic, M. Grabowski, G. Heringer, I. Herrera, W. Huang, K.L. Kamelamela, N.I. Kirichenko, A. Kouba, M. Kourantidou, I. Kurtul, G. Laufer, B. Liptak, C. Liu, E. Lopez-Lopez, V. Lozano, S. Mammola, A. Marchini, V. Meshkova, M. Milardi, D.L. Musolin, M.A. Nuñez, F.J. Oficialdegui, J. Patoka, Z. Pattison, D. Pincheira-Donoso, M. Piria, A.F. Probert, J. J. Rasmussen, D. Renault, F. Ribeiro, G. Rilov, T.B. Robinson, A.E. Sanchez, E. Schwindt, J. South, P. Stoett, H. Verreycken, L. Vilizzi, Y-J. Wang, Y. Watari, P.M. Wehi, A. Weiperth, P. Wiberg-Larsen, S. Yapıcı, B. Yoğurtçuoğlu, R.D. Zenni, B.S. Galil, J.T.A. Dick, J.C. Russell, A. Ricciardi, D. Simberloff, C.J.A. Bradshaw & P.J. Haubrock (2024): Taming the terminological tempest in invasion science. Biol. Rev., 99(4), 1357–1390.

Uysal, İ. & B. Boz (2018): The most dangerous invasive alien species in Turkey and poisonous marine alien species in Turkey Report, October 2018. T.C. Tarım ve Orman Bakanlığı Doğa Koruma ve Milli Parklar Genel Müdürlüğü, Ankara. 68 pp.

Yerli, S.V., F. Mangıt, Ö. Emiroğlu, V. Yeğen, R. Uysal, E. Ünlü, A. Alp, E. Buhan, T. Yıldırım & M. Zengin (2014): Distribution of invasive *Carassius gibelio* (Bloch, 1782) (Teleostei:Cyprinidae) in Turkey. Turk. J. Fish. Aquat. Sci, 14, 581–590.