



First Record of Non-Indigenous Fish *Hemichromis letourneuxi* (Cichlidae) From Pınarbaşı Creek (Burdur, Turkey)

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ABSTRACT

Freshwater habitats of Anatolia have been subject to the impacts of many invasive alien fish species. African jewel-fish, *Hemichromis letourneuxi* Sauvage, 1880 is an ornamental freshwater fish which is widely distributed throughout northern half of Africa. In this study, *H. letourneuxi* was collected from Pınarbaşı Creek, Burdur Province, Turkey. Introduced specimens of *H. letourneuxi* in this area may be the result of escapes from fish farms, intentional releases from nearby ornamental fish farms or aquariums. This study discusses the potential ecological impacts of *H. letourneuxi* upon native fish fauna and ecosystem in the area.

Keywords: Alien, ecological impact, biodiversity, endemic

Pınarbaşı Deresi (Burdur, Türkiye)'nde Yabancı Balık Türü *Hemichromis letourneuxi* (Cichlidae)'nin İlk Kaydı

ÖZ

Anadolu'daki tatlısu habitatları çok sayıda istilacı yabancı balık türünün etkilerine maruz kalmıştır. Afrika mücevher balığı, *Hemichromis letourneuxi* Sauvage, 1880, Afrika'nın kuzey yarısı boyunca yaygın olarak bulunan bir tatlı su süs balığıdır. Bu çalışmada, *H. letourneuxi* türü Burdur İli Pınarbaşı Deresi'nden toplanmıştır. Bu bölgedeki yabancı *H. letourneuxi* bireylerinin girişi balık çiftliklerinden kaçmalar veya süs balık çiftlikleri ile akvaryumlardan kasıtlı olarak salınma şeklinde sonuçlanmış olabilir. Bu çalışma, *H. letourneuxi*'nin bölgedeki yerli balık faunası ve ekosistemi üzerindeki potansiyel ekolojik etkilerini tartışmaktadır.

Anahtar Kelimeler: Yabancı, ekolojik etki, biyoçeşitlilik, endemik

INTRODUCTION

Several species of African cichlid are now established in the natural water bodies of Turkey. Most of these exotic cichlids were introduced by escape or dumping from fish farms (Innal and Erk'akan, 2006). The introduction of the African cichlid to new aquatic systems has resulted in significant changes in the water quality and biological diversity (Canonica et al., 2005).

Hemichromis letourneuxi Sauvage, 1880 is a small, popular ornamental freshwater fish. The species founds in Lake Turkana (Kenya), the middle and lower reaches of the Nile River (below Murchison Falls, Uganda), in oases throughout the Sahara, in Lake Chad and its inflowing streams (Cameroon, Chad, Niger and Nigeria) and in the Niger, Volta, Komoe, Bandama, Sassandra, Gambia and Senegal Rivers in West Africa (Loiselle, 1992). Native populations distributed in Algeria, Burkina

Faso, Cameroon, Chad, Cote d'Ivoire, Egypt, Ethiopia, Gambia, Ghana, Kenya, Niger, Nigeria, Senegal, Sudan and Uganda (Daget et al., 1991; Loiselle, 1992; Bailey, 1994; Okeyo, 2003; Getahun, 2007; Kara, 2012).

The species has become established in aquatic habitats in Florida and Hawaii, Puerto Rico and probably Mexico (Schofield et al., 2014; USGS, 2016).

A range of exotic fishes has become established throughout the Burdur Closed Basin (Küçük et al., 2016). Five exotic fishes were reported from study area (Pınarbaşı Creek) (Innal and Giannetto, 2017). The goal of this work was to document the first record of *H. letourneuxi* in freshwater fishes in Turkey. The potential ecological impact of the species upon native fish fauna and ecosystem are discussed and some suggestions are represented.

MATERIALS AND METHODS

This ichthyological survey takes place within Pınarbaşı Spring Creek (Figure 1) (37°27'09.39"N-30°03'28.58"E; 37°27'13.77"N-30°03'03.56"E) in the Burdur Province within the Lake District Region in south-western Anatolia (Turkey) in 01 March 2017. Electro-fishing (SAMUS 725) was employed to collect fish specimens. Collected specimens were preserved in 20% formalin solution immediately after anaesthesia, and then were subsequently stored in 4% formalin solution. Muscle tissues were preserved in a 96% ethanol solution for molecular analyses. In order to identify the specimens based on morphometric characteristics, a key for the genus *Hemichromis* was used (Loiselle, 1992). Additionally, molecular identification of specimens (as the barcode; mitochondrial DNA, cytochrome C oxidase subunit I: COI) was applied to verify diagnostic identification.



Figure 1. Pınarbaşı spring creek, Burdur Province

RESULTS

Three specimens of *H. letourneuxi* were caught from Pınarbaşı Creek. The specimens ranged in size 60 and 79 mm total length. Our collections represent the first records of this fish from aquatic systems in Turkey.

During the survey, in addition to *H. letourneuxi* other six fish taxa including Redbelly tilapia *Coptodon zillii* (Gervais, 1848), Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758), Burdur Loach *Oxynoemacheilus anatolicus* Erk'akan, Özeren & Nalbant 2008, Eastern mosqui-

tofish *Gambusia holbrooki* Girard, 1859, Prussian carp *Carassius gibelio* (Bloch, 1782) and North African catfish *Clarias gariepinus* (Burchell, 1822) were caught.

H. letourneuxi (Figure 2) is a small fish with a slender body and a rounded caudal fin. Mouth large and wide, body colouration of fresh specimens is green-yellow on dorsal, yellowish on flanks and whitish on ventral. The specimens has small, brilliant blue iridescent spots or flecks on the head, body and fins. Fresh specimens have an unocellated median spot located entirely above the lateral line and preserved individuals have

three dark black spot on the flanks of; above the lateral line, on the operculum, midline of body and caudal peduncle.

Based on the similarity of the COI sequences between the unknown samples and the nucleotide database,

species identifications were made (National Centre for Biotechnology Information (NCBI), U.S. National Library of Medicine, 2018) by nucleotide blast tool. The sequences paired with *H. letourneuxi* in NCBI nucleotide database..

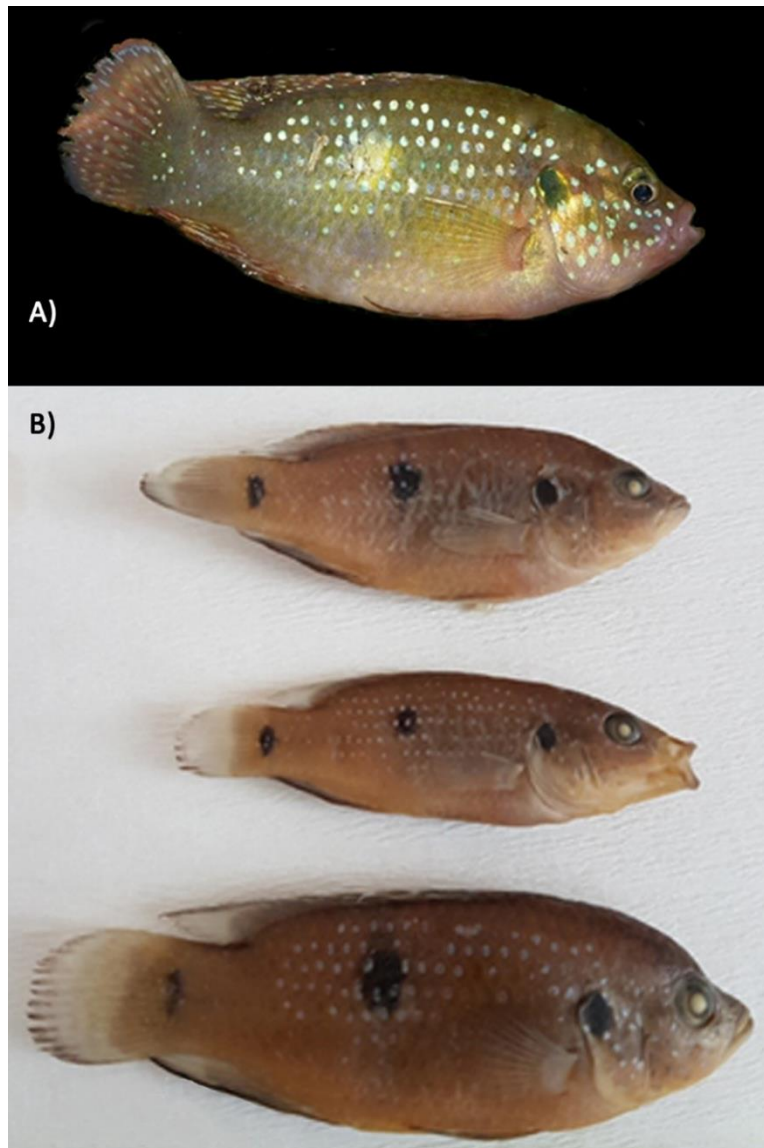


Figure 2. *Hemichromis letourneuxi*, A) fresh specimen, B) formalin preserved specimens.

DISCUSSION

Numerous fish species have been transported around the world by the aquarium trade, often establishing populations in areas far outside their natural range. To date, several exotic aquarium species have been reported from Turkey (Emiroğlu et al., 2016). In this study, *H. letourneuxi* was recorded for the first time in Turkey. Well-established population of *H. letourneuxi* was observed in Pınarbaşı Spring Creek, Burdur.

This area is a specific closed basin: waters from the Pınarbaşı Spring Creek flow into Karaçal Dam Lake through the Bozçay Creek. Then, from the dam lake, waters reach Burdur Lake. There are several aquarium industry ponds located nearby areas. Introduced populations of *H. letourneuxi* in this area may be the result of escapes from fish farms or may have originated from intentional releases from nearby ornamental fish farms or aquariums.

It is reported that *H. letourneuxi* has rapidly expanded in Florida because of wide environmental tolerances, the ability to colonise disturbed habitats, trophic opportunism, fast growth rates and advanced parental care of offspring. Potential ecological impacts upon native fish fauna may include resource competition and predation of aquatic invertebrate communities as a whole. Additionally, *H. letourneuxi* becomes aggressive when breeding as territories are established on the substrate and defended against intruders (USGS, 2016). There is concern about the potential of *H. letourneuxi* to affect native aquatic communities' negatively through predation or by consuming shared prey. Additionally, *H. letourneuxi* is territorial and aggressive, potentially able to affect native species either directly (e.g., by exclusion from optimal habitats) or indirectly (e.g., diverting energy into avoiding interactions, thus reducing fitness or body condition) (Schofield et al., 2014).

During the survey a total of six species were caught with *H. letourneuxi*. Under this circumstance it is shown that *H. letourneuxi* is very competitive and resistant species even living coincide many invasive species. It can be claim that *H. letourneuxi* can be spread and well-established if translocated to new habitats. Increasing population of *H. letourneuxi* may threaten the population of *O. anatolicus* which is the only naturally distributed species in this area, evaluated as Endangered by IUCN (Freyhof, 2014), locally endemic and alive only some isolated populations.

Biological invasions are recognized as a major threat to biodiversity (Vitousek et al., 1996; Sala et al., 2000). Invasive fish species caused major threats to biological diversity occurred by invasion of habitats and predation on local fish species, and cause rapidly decrease or local extinction of endemic species.

Many adverse effect of exotic species have been observed however not well documented yet. Therefore, their influences on native aquatic communities are poorly understood in Turkey. Deleterious impacts of *H. letourneuxi* have inferred on aquatic habitats and invertebrate, amphibian and fish communities from the previous introduced area in Florida (Loftus et al., 2006; Schofield et al., 2014). Loftus et al. (2006) observed that the native to Florida *Lepomis marginatus* would not reproduce in close proximity to *H. letourneuxi* in controlled mesocosm trials (Loftus et al., 2006). As a result, it is likely that the species will impact on aquatic invertebrate and fish communities and therefore affect broad scale environmental processes such as food webs and nutrient cycles in Turkey as reported in Florida (Schofield et al., 2014). It is expected that this kind of effect more strongly occurs

specially in anthropogenically-modified habitats (O'Connor and Rothermel, 2013).

Up to date approximately 30 exotic fish species have been reported in inland waters of Turkey (Innal and Erk'akan, 2006; Tarkan et al., 2015; Emiroğlu et al., 2016; Yoğurtçuoğlu and Ekmekçi, 2018). Some of them (e.g. *Salvelinus alpinus*, *S. fontinalis*) have not established successfully in the natural ecosystems while some taxa including *Carassius gibelio*, *Carassius auratus*, *Pseudorasbora parva*, *Lepomis gibbosus*, *Atherina boyeri*, *Gambusia holbrooki*, *Oreochromis niloticus* and *Coptodon zillii* have established successfully and generated self-sustaining populations in the natural ecosystems (Tarkan et al., 2015; Çiçek et al., 2015; Innal and Giannetto, 2017; Emiroğlu et al., 2018). According to Emiroğlu et al. (2018), several populations of *O. niloticus* reported from Çukurova, the Orontes River, Hırla Lake, Köyceğiz Lake and Sakarya River Basin. This species was also collected from research area (Pınarbaşı Creek, Burdur).

In conclusion, this study presents the first records of *H. letourneuxi* from natural freshwater systems in Turkey. The current distribution range and population density of *H. letourneuxi* in inland waters should be investigated and an immediate eradication program should be created for this species.

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