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THE OSCAR, *ASTRONOTUS OCELLATUS* (AGASSIZ, 1831) (CICHLIDAE): A DELIBERATE AQUARIUM TRADE INTRODUCTION IN THE EUPHRATES RIVER, IRAQ

SUMMARY

The first record of a single specimen of oscar, *Astronotus ocellatus*, native to Amazon basin of Peru, Colombia and Brazil, is reported from the inland waters of Iraq. The specimen was caught from one of the branches of the Euphrates River to the east of the Barnun city, ca. 5 km to the NW of Hilla city in Babylon Province in central Iraq in December 2021 using rod and line. The capture of a sub-adult specimen, 186.7 mm in total length, indicates the first record of another aquarium fish species in the freshwater system of Iraq. The aquarium trade pathway is the suspected factor for the presence of this species in the Iraqi freshwater area.

Key words: biodiversity, new locality, new occurrence, aquarium trade, non-Indigenous Species

INTRODUCTION

Biological invasions are one of the most disturbing harms in the natural environment that instigate destructions such as habitat degradation, hybridization, the spread of disease, and economic problems (Pimentel, 2002; Gozlan, 2009; Cucherousset and Olden, 2011). Despite the worry about invasions, fishes continue fleeing from captivity into a new habitats, particularly through vectors of aquaculture, the ornamental-fish trade, and sport fishing (Gozlan, 2008). For such reasons, fishes are some of the most often introduced aquatic animals in the world (Gozlan, 2008, 2009). In spite of the difficulties that the fish can face during invasion, they usually adapt physiologically so they can survive in the new habitats. (Rahel and Olden, 2008; Gozlan, 2009; Capps and Flecker, 2013).

The introduction of species beyond their natural range has been cited as one of the most ecologically destructive human actions (Carlton, 2001; Brown and Sax, 2004). The threat of introduced invasive species on biodiversity is considered second only to that of habitat loss and degradation (Kolar and Lodge, 2001; Olden *et al*., 2004). Their effects are severe in biogeographically isolated environments as they modify the colonization-extinction equilibrium.

Many fish exporters from the Far East do not breed all the fish they export but buy from small-scale breeders (FAO, 2005-2015). For example, Singapore as major ornamental fish exporting country, imports much of the Asian production but then re-exports worldwide (Oliver, 2003; Wabnitz *et al*., 2003).

Astronotus ocellatus (Agassiz, 1831), usually known as Oscar, is native to the Amazon basin of Peru, Colombia and Brazil (Kullander, 2003). This species is much-appreciated for its meat regarded as a food fish of the highest quality on the Amazonian market (Delgado *et al*., 2014; Tavares-Dias *et al*., 2014). It was introduced around the world as a popular aquarium fish (Fury and Morello, 1994; Maceda-Veiga *et al*., 2014). It has been reported as introduced or established in the continental United States, Puerto Rico, Australia, Poland, Singapore, and southern Brazil (Ng *et al*., 1993; Fury and Morello, 1994; Nowak, *et al*., 2008; Webb, 2008; Julio Junior *et al*., 2009; Nico *et al*., 2014). In its native range, the species lives in warm freshwater bodies, either Amazon basin white waters (such as the Solimoes and Amazon rivers) that are rich in suspended solids and have a neutral pH, or in acidic and ion-poor black waters of the Rio Negro (Sioli, 1984; De Pinna, 2006). *Astronotus ocellatus* has the potential to invade a wide range of environments (Val *et al*., 2006; Nico *et al*., 2014) owing to its aggressive and competitive behaviour, very tolerant of a wide range of physical water conditions including low pH, low dissolved oxygen concentrations (Muusze *et al*., 1998; Almeida-Val *et al*., 2000; Sloman *et al*., 2006), high temperatures (Val *et al*., 2006), and low temperatures (Shafland and Pestrak, 1982). High resistance to environmental stressors makes *A. ocellatus* a successful ornamental fish but also makes it an invasive threat (Gozlan, 2009).

The only exotic fish introductions via aquarium trade reported from the freshwater system in Iraq are those of *Pangasianodon hypophthalmus* (Sauvage, 1878) (see Khamees *et al*., 2013), *Mollienesia latipinna* (Lesueur, 1821) (see Al-Faisal and Mutlak, 2015), and *Atractosteus spatula* (Mutlak *et al*., 2017). In the freshwater system of Iraq, three cichlid species were recorded, *Oreochromis aureus* (Steindacher 1864) (Mutlak and Al-Faisal, 2009) *Oreochromis niloticus* (Linnaeus, 1758) (Al-Faisal and Mutlak, 2015) and *Coptodon zillii* (Gervais, 1848) (Al-Sa'adi, 2007). The Oscar species reported in this study will increase the number of the species of the family Cichlidae to four.

MATERIALS AND METHODS

A single specimen of Oscar, *Astronotus ocellatus* (Agassiz, 1831) (Figure 1), a species native to the Amazon basin of Peru, Colombia and Brazil, was captured from Haji Ali watercourse (less than 2 meters in depth), a narrow irrigation canal branching from the Euphrates River to the east of the Barnun city, ca. 5km to the northwest of Hilla city in Babylon Province in central Iraq (32° 33' 46.6 N, 44° 23' 09.7 E) (Figure 2). The fish specimen was captured by a fisherman (Ali Al-Murshidi) working the area described above in December 2021 using line and rod. The specimen was identified according to Page and Burr (1991). While the specimen was with the fisherman, it was examined, measured and photographed, but it was not kept and stored. The nomenclature follows Eschmeyer *et al*. (2017). A series of morphometric measurements were made with a ruler to the nearest 1 mm following the methods of following (Barel *et al*., 1977; Meyer, 1987) (Table 1).

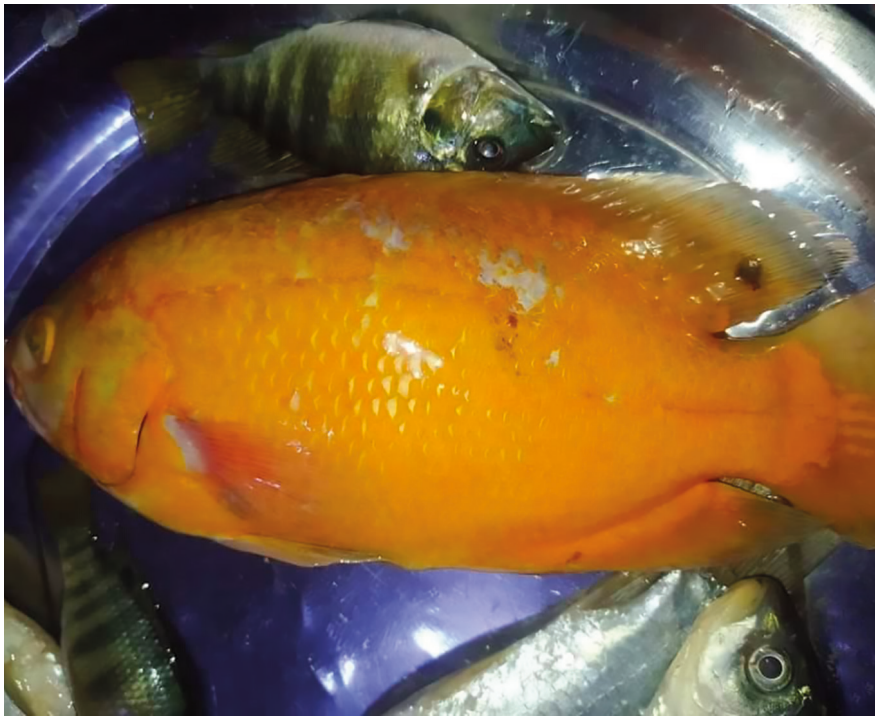

Figure 1. *Astronotus ocellatus*, 186.7 mm total length collected from a narrow irrigation canal branching from the Euphrates River, northwest of Hilla city in Babylon Province, central Iraq.

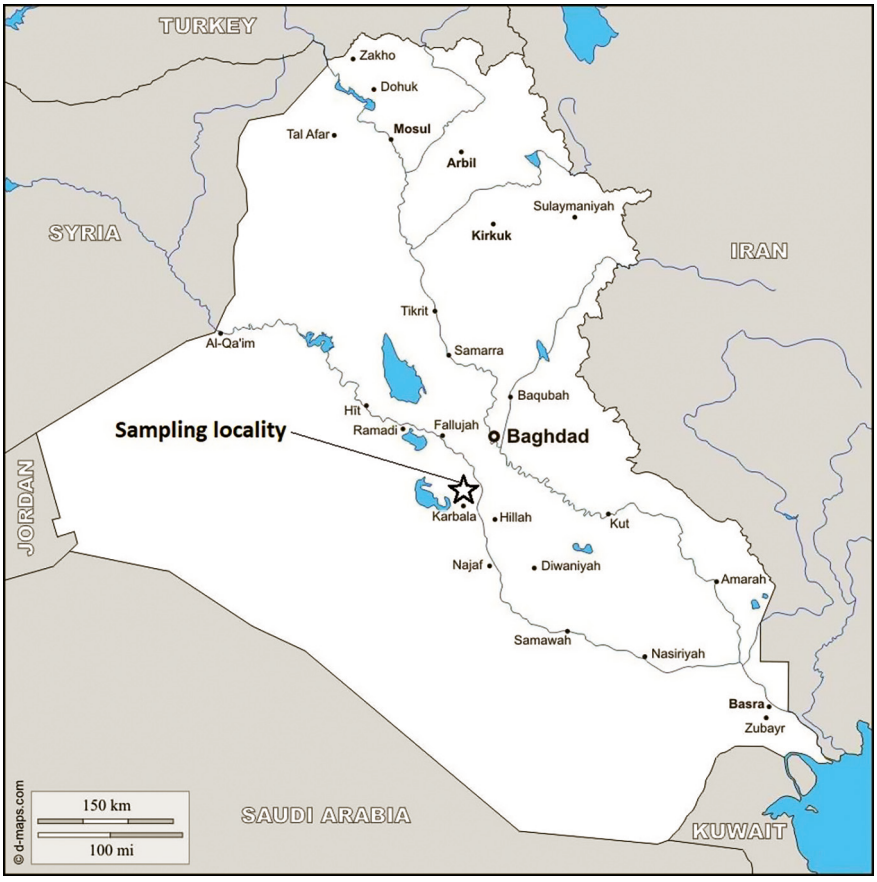

Figure 2. Map showing sampling locality.

RESULTS

The specimen of *Astronotus ocellatus* measured 186.7 mm total length and showed the following set of characters: standard length 156.7 mm (83.93 % in TL); head length 31.3 mm (19.97 % in SL); eye diameter 1.5 mm (4.79 % in HL); preorbital length 5.3 mm (3.38 % in SL); predorsal fin length 53.3 mm (34.01 % in SL); postdorsal fin length 130 mm (82.96 % in SL); prepectoral fin length 32 mm (20.42 % in SL); pectoral fin length 36 mm (22.97 % in SL); prepelvic fin length 39.3 mm (25.8 % in SL); preanal fin length 73.3 mm (46.78 % in SL); postanal fin length 132 mm (84.24 % in SL); caudal peduncle depth 25.3 mm (16.15 %in SL); caudal peduncle length 20 mm (12.76 % in SL). Body oval-shaped, laterally compressed, with rounded caudal fin.

Mouth large, with thick lips. Presence of seven preopercular pores. The first gill-arch is without a lobe. The gill rakers are short and thick, with many denticles. The dorsal and anal fin bases are densely scaled. The body is dark orange, with bright orange opercle, ventral parts of the lateral sides of the body and the edges of the fins. The base of the pectoral fin is dark orange.

DISCUSSION

The maximum total length *A. ocellatus* attained is 457 mm TL (IGFA, 2001) and the common total length is 240 mm (Hugg, 1996). The total length of the specimen here described is 186.7 mm, which is just over half of the common total length given by Hugg (1996). Our specimen is larger than that of Beeching (1995) (120 mm TL from USA local distributor), but smaller than those obtained by Liew *et al*. (2012) (200 mm TL from Singapore), Magalhães *et al*. (2019) (198 mm TL from Brazil) and Mansur *et al*. (2021) (202 mm TL from Brazil).

The natural colour of *A. ocellatus* in the wild is blackish-brown with red markings and black blotches on the sides; black dorsal, anal and caudal fins; and a small, black, ocellus at the upper caudal base. The domesticated varieties are available in colours ranging from orange and gold to red (Liew *et al*., 2012). The yellow colour and the absence of the small, black, ocellus at the upper caudal base of the specimen examined in this study suggests that it is either an aquarium escapee or originated from an aquaculture facility. Naturally, fish cannot produce their pigments, the pigments, which are synthesized by plants, algae and microorganisms, need to be incorporated into their diet (Alishahi *et al*., 2015). One of the greatest tasks in the ornamental fish industry is to duplicate the accurate natural colour of the fish in the captive environment. Carotenoids is one of the four chief pigment groups that give colour to the skin and tissues of animals and plants. These pigments can dissolve in fat, giving the skin the yellow and red colours. They also give the orange and green colors to the egg, skin and flesh of many fish (Fuji, 1969). Carotenoid pigments are usually produced by phytoplankton and plants and they are divided into two groups as carotenes and xanthophylls (Alishahi *et al*., 2015). Among the carotenoids is the Astaxanthin that originates from diet and that fish cannot manufacture. The wild fish get their astaxanthin through their prey organisms, while in aquaculture (aquariums and fish farms) astaxanthin is added to the feed in the form of nature-identical synthetic beadlets (Bjerkeng *et al*., 1999).

There are three possibilities for the specimen *A. ocellatus* to present in one branch of the Euphrates River, at the centre of Iraq. First, the specimen might swim with the current of the Euphrates River coming from Turkey;

second, swam with the current of Tigris River coming from Iran; an escapee from one of the aquaculture facilities found in the nearby area where the specimen was collected. For the second possibility, Turkey has aquaculture facilities that they rear *A. ocellatus* together with the other aquarium species (Kayış *et al*., 2013). Given the small size of the fish (186.7 mm TL), such specimen can't swim more than 2000 km and enter the freshwater system of Iraq through Syria. The distance problem will be the same for the second third option, where the specimen needs to swim in the Tigris River more than 1000 Km to enter the freshwater system of Iraq through one of its tributaries originated from Iran, where aquaculture facilities culturing ornamental fish species are available there (Alishahi *et al*., 2015). The third possibility is more acceptable and realistic than the first two options. Several private aquaculture facilities culturing mainly different species of carp together with some aquarium species including *A. ocellatus*. These facilities are located in the neighbourhood about a few hundred of metres from the area where the fish has been caught.

In the case of the establishment of *A. ocellatus* in the freshwater system of Iraq, the interaction of this species with local species needs to be studied mainly with those that require similar ecological conditions. Through the management plans in progress in the Euphrates-Tigris Rivers in Iraq, a special attention should be taken to record any invasive species and put a management strategy to eliminate it from the environment.

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