

First record and distribution of the blue tilapia, *Oreochromis aureus* (Steindachner, 1864) (Perciformes: Cichlidae) in inland waters of Iran

Hussein VALIKHANI¹, Asghar ABDOLI^{*1}, Bahram H. KIABI², Farshad NEJAT¹

¹ Department of Biodiversity and Ecosystem Management, Environmental Sciences Research Institute, Shahid Beheshti University, GC, Tehran, Iran.

² Department of Marine Biology, Faculty of Biological Sciences, Shahid Beheshti University, Tehran, GC, Iran.

*Email: asabdoli@yahoo.com

Abstract: The blue tilapia, *Oreochromis aureus* (Steindachner, 1864) is recorded for the first time from the Arvand and Karun River drainages in Khuzestan province, Iran. This species is the second tilapia fish, recorded and confirmed by specimens from natural water bodies of Iran. The relative abundance and location records of the observed blue tilapia are presented. As tilapia species have high resistance for different environmental conditions and can easily propagate in new habitats, thus its monitoring is highly recommended.

Keywords: Tilapia species, Exotic fishes, Threats, Relative abundance, Khuzestan Province.

Introduction

Invasive species are alien (non-native) organisms that have been introduced into an area outside of their natural range, establishing self-sustaining populations and spreading beyond their initial point of introduction, with deleterious impacts on the environment, economy and human health (Coad & Abdoli 1993; Kolar & Lodge 2001; Esmaili et al. 2014; Lymbery et al. 2014). Freshwater ecosystems and fish taxa are particularly affected by introductions (Marchetti et al. 2004; Clavero & Garcia-Berthou 2006). Unfortunately, more than 32 alien (exotic) fish species were reported from Iran of which 25 species are confirmed by specimens and some of them (e.g., *Carassius gibelio*, *Pseudorasbora parva*, *Gambusia holbrooki*) have already established breeding populations (Coad & Abdoli 1993; Esmaili et al. 2014). The blue tilapia, *Oreochromis aureus* (Fig. 1) is a species in the Perciformes order and Cichlidae family. Smith-Vaniz & Williams (1993) described the characteristics of *O. aureus* in the state of Florida, USA: first gill arch with 20-26 rakers on lower limb (24-32 total, usually >26); caudal fin of juveniles and frequently adults with indistinct,

irregular dusky markings or a dark reticulum with light interstices; sides of adults generally bluish-gray, white on belly, except in darker individuals each scale may have a small dark spot or dusky blotch anteriorly which gives the appearance of rows of markings; breeding males mostly bluish-gray, throat and cheeks light but not distinctly lighter than rest of body; and in live fishes, genital papilla translucent, not chalky white.

Material and Methods

Oreochromis aureus specimens were collected by gill net from June 2015 to October 2015 during a one-year survey (October 2014 to October 2015), carried out on the status of invasive alien redbelly tilapia, *Coptodon zillii* (Gervais, 1848) formerly known as *Tilapia zillii* (Gervais, 1848) in Khuzestan Province, southwestern Iran. The specimens were captured from 4 locations including the Arvand River (30°17'N, 48°18'E), the Bahmanshir River (30°17'N, 48°22'E), the Karun River (31°19'N, 48°40'E; 30°25'N, 48°11'E; 30°26'N, 48°11'E; 30°25'N, 48°10'E) and the Korramshahr Cane Canals (30°47'N, 48°10'E; 30°35'N, 48°10'E) (Fig. 2). The



Fig.1. General body shape of *Oreochromis aureus* from the Karun River (June 2015).

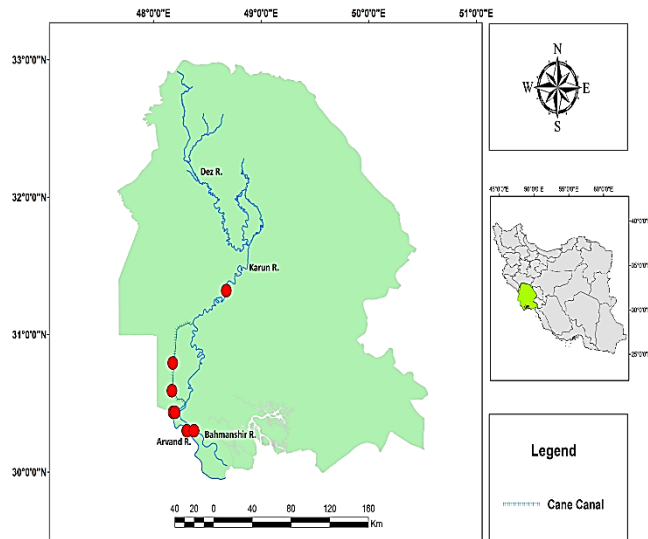


Fig.2. The locations of the observed blue tilapia, *Oreochromis aureus*, in Khuzestan province, Iran.

specimens were euthanized with benzocaine (100mg/L) before fixation in formalin (10%), and were transferred to the Institute of Environmental Sciences of Shahid Beheshti University, Tehran. Meristic and morphometric characteristics were measured following Abdoli (2000) and identification of the collected fishes was done following the key provided by Smith-Vaniz & Williams (1993).

Results

Meristic and morphometric characteristics of 17 examined specimens are presented in Tables 1, 2. The results indicate the presence of 27-30 gill rakers on the first gill arch, in agreement with the key of Smith-Vaniz & Williams (1993). None of the specimens had regular dark vertical stripes. Trewevas

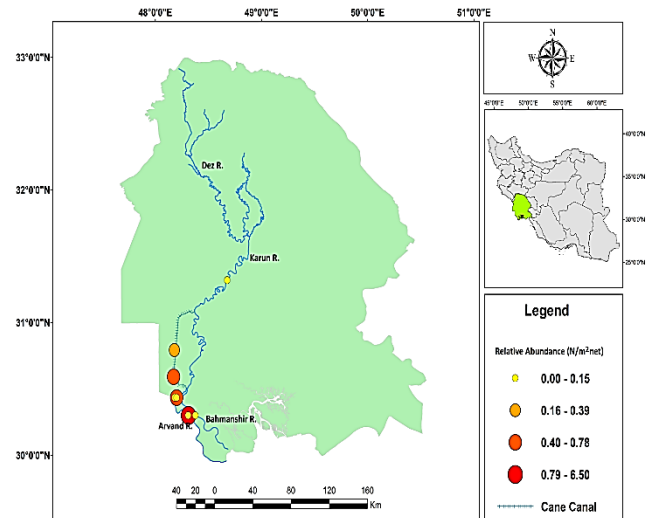


Fig.3. The relative abundance of *Oreochromis aureus* in Khuzestan province, Iran.

(1983) pointed out the difference of caudal fin between *O. aureus* and *O. niloticus*. The caudal fin is with regular dark vertical stripes in *O. niloticus*, while stripes are less obvious or variable in *O. aureus*. The relative abundance of the blue tilapia was evidenced by the unit of number of the fish/m² net in Khuzestan province (Fig. 3).

Discussion

After the introduction of the redbelly tilapia in Shadegan wetland, Khuzestan Province, southwestern Iran (Khaefi et al. 2014), we observed another species in the cichlid family, *O. aureus* also known as the blue tilapia for the first time from different localities (Karun River, Arvand River, Bahmanshir River and Korramshahr Cane Canals) located in Khuzestan Province which drain to the Persian Gulf. There are several species of tilapia in countries of neighboring Iran. The blue tilapia was captured from the Khabour River in Syria, presumably an escapee from a fish farm in the basin of this tributary of the Euphrates River (Coad 1996); *O. aureus* was brought from Israel in 1989 by researchers of Animal Science Department of Agricultural Faculty of Çukurova University (ASDAF), Turkey (Altun 2006) and it is also recorded in Iraq by Mutlak and Al-Faisal (2009) at

Table 1. Meristic characteristics of 17 collected specimens of *Oreochromis aureus* from the Karun River.

Meristic Characteristics	Range	Mean	SD
Upper lateral line scales	13-22	20.75	1.89
Lower lateral line scales	13-16	14.53	0.87
Scales between upper and lower L.L.	2-2	2.00	0.00
Longitudinal scale rows	25-28	26.94	1.09
Scales on cheek in horizontal series	2-3	2.35	0.49
scales between base of pectoral and pelvic fin	5-7	5.94	0.75
scales below upper L.L. before pelvic fin	13-14	13.24	0.44
Dorsal fin spine	14-16	15.18	0.53
Dorsal fin soft ray	11-13	12.06	0.56
Anal fin spine	3-3	3.00	0.00
Anal fin soft ray	9-10	9.06	0.24
Pectoral fin soft ray	13-14	13.76	0.44
Pelvic fin spine	1-1	1.00	0.00
Pelvic fin soft ray	5-5	5.00	0.00
Total number of gill rakers	27-30	28.5	1.03
Number of gill rakers on upper limb	5-8	6.69	0.87
Number of gill rakers on lower limb	20-23	21.81	0.83

Table 2. Morphometric characteristics of 17 collected specimens of *Oreochromis aureus* from the Karun River.

Morphometric Characteristics	Range	Mean	SD
Total length (mm)	151-197	169.41	11.09
Standard length (mm)	112-153	130.18	9.21
In the percentage of standard length			
Maximum body depth	37.59-40.83	39.41	1.08
Minimum body depth	12.78-15.18	14.16	0.66
Head length	30.77-35.48	33.20	1.26
Caudal-peduncle length	11.29-14.18	12.90	0.71
Pre-dorsal length	33.58-41.06	36.73	1.74
Post-dorsal length	10.45-14.38	12.41	0.97
Length of dorsal fin	52.94-64.54	58.72	2.77
Length of anal fin	15.03-19.23	16.64	1.02
Length of pectoral fin	28.76-35.46	32.94	1.71
Length of pelvic fin	24.39-33.59	29.22	2.40
In the percentage of head length			
Mouth width	20.93-35.00	27.93	4.05
Eye diameter	13.04-18.42	14.87	1.34
Orbital length	18.18-23.68	21.42	1.46
Interorbital width	25.49-32.50	29.47	2.09
Pre-orbital length	23.91-29.41	26.98	1.40
Post-orbital head length	37.25-47.62	43.00	2.70
Mandible length	20-34.09	26.42	3.4

the main outfall drain in Basrah city. The Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) is present

naturally in the Asi River (Hatay, Turkey) passing through Syria (Gürlek 2004). Recently, Al-Faisal and

Mutlak (2014) recorded the Nile tilapia from the Arvand River (Shatt Al-Arab River), southern Iraq and this species could become established in Iran through connected water bodies. *Captodon zillii* was observed in Syria (Beckman 1962), Turkey (Altun 2006), Iraq (Job 1967; Mutlak & Al-Faisal 2009; Al-Zaidy 2013) and Iran (Khaefi et al. 2014; Roozbahar et al. 2014; Esmaeili et al. 2014). Tilapias have high resistance for different environmental conditions and can easily propagate in new habitats. This feature may contribute to the successful breeding and establishment of this exotic cichlid fish in the inland waters of Iran in the near future. As suggested by Khaefi et al. (2014) the monitoring of this newly introduced fish is highly recommended by scientists, conservationists, and environmentalists.

Acknowledgments

We would like to express our sincere appreciation to Mr. Lahijanzadeh (Head of provincial office of environment of Khuzestan), M. Sadeghsaba, A. Elmi, O. Sedighi and S.M. Kharazian for providing funding, logistic and accommodation. This project was supported by the Khuzestan Department of the Environment to collect basic data for status of *T. zillii* in this province by grant No.: 93/6007. We also thank K. Khezri for his help in the sampling.

References

- Abdoli, A. 2000. *The Inland Water Fishes of Iran*. Tehran: Iranian Museum of Nature and Wildlife. (In Farsi).
- Al-Faisal, A.J. & Mutlak, F.M. 2014. First record of the Nile tilapia *Oreochromis aureus* (Linnaeus, 1758), from the Shatt Al-Arab River, South Iraq. *Mesopotamian Journal of Marine Science* 29 (1): 45-50.
- Altun, T.N.; Tekelioglu & Danadas D. 2006. Tilapia culture and its problems in Turkey. *Journal of Fish and Aquatic Science* 23 (3-4): 473-478.
- Al-Zaidy, K.J. 2013. First record of *Tilapia zillii* Gervais, 1848 in Al-Delmj marsh west Al-Diwania city middle of Iraq. *Diyala Agriculture Science Journal* 5: 9-16.
- Beckman, W.C. 1962. *The freshwater fishes of Syria and their general biology and management*. Rome: Food and Agriculture Organization, Fisheries Biology Technical Paper, 297 p.
- Clavero, M. & Garcia-Berthou, E. 2006. Homogenization dynamics and introduction routes of invasive freshwater fish in the Iberian Peninsula. *Ecological Applications* 16: 2313-2324.
- Coad, B.W. 1996. Exotic fish species in the Tigris-Euphrates basin. *Zoology in the Middle East* 13: 71-83.
- Coad, B.W. & Abdoli, A. 1993. Exotic fish species in the fresh waters of Iran. *Zoology in the Middle East* 9: 65-80.
- Esmaeili, H.R.; Teimori, A.; Owfi, F.; Abbasi, K. & Coad B.W. 2014. Alien and invasive freshwater fish species in Iran: Diversity, environmental impacts and management. *Iranian Journal of Ichthyology* 1(2): 62-72.
- Gürlek, M. 2004. Genetic and morphologic identification of tilapia (*Tilapia*) species found in Çukurova and Hatay Regions and determination of key characters for species identification (master's thesis). (In Turkish). Department of Fisheries, Institute of Natural and Applied Science, University of Mustafa Kemal, Hatay, Turkey.
- Job, T.J. 1967. Status of fish culture in the Near East region, In: Pillay T.V.R. (ed), *Proceedings of the FAO World Symposium on Warm-Water Pond Fish Culture*. Fisheries Report. Rome: Food and Agriculture Organization, pp. 54-69.
- Khaefi, R.; Esmaeili, H.R.; Zareian, H. & Babaei, S. 2014. The first record of the redbelly tilapia, *Tilapia zillii* Gervais, 1848 in freshwaters of Iran. *Turkish Journal of Zoology* 38: 96-98.
- Kolar, C.S. & Lodge, D.M. 2001. Progress in invasion biology: predicting invaders. *Trends in Ecology and Evolution* 16: 199-204.
- Lymbery, A.J.; Morine, M., Kanani, H.J., Beatty, S.J. & Morgan, D.J. 2014. Co-invaders: The effects of alien parasites on native hosts. *International Journal for Parasitology: Parasites and Wildlife* 3: 171-177.
- Marchetti, M.P.; Moyle, P.B. & Levine, R. 2004. Invasive species profiling? Exploring the characteristics of non-native fishes across invasion stages in California. *Freshwater Biology* 49: 646-661.
- Mutlak, F.M. & Al-Faisal A.J. 2009. A new record of two exotic cichlids fish *Oreochromis aureus*

- Steindacher, 1864 and *Tilapia zilli* Gervais, 1848 from south of the main outfall drain in Basrah city. *Mesopotamian Journal of Marine Science* 24(2): 160-170.
- Roozbehfar, R.; Dehestani-Esfandabadi, M. & Roozbehfar, S. 2014. First record of the redbelly tilapia, *Tilapia zilli* Gervais, 1848 in Iran. *Journal of Applied Ichthyology* 1-2.
- Smith-Vaniz, W.F. & Williams J.D. 1993. Key to cichlid fishes of Florida. National Fisheries Research Center, National Biological Survey. Retrieved from <https://www.google.com/#q=Fish+Identification+Guide+For+Throw+trap+Samples+Florida+International+University+Aquatic+Ecology+Lab+April+2007>.
- Trewevas, E. 1983. Tilapiine Fishes of the Genera *Sarotherodon*, *Oreochromis* and *Danakilia*. British Museum of Natural History, Publ. Num. 878. Comstock Publishing Associates. Ithaca, New York.

Archive of SID

اولین گزارش حضور و پراکنش ماهی تیلاپیای آبی *Oreochromis aureus* (Steindachner, 1864) (راسته سوف ماهی شکلان: خانواده سیکلیده) در آب های داخلی ایران

حسین ولیخانی^۱، اصغر عبدلی^{۲*}، بهرام کیابی^۲، فرشاد نجات^۱

^۱گروه تنوع زیستی و مدیریت اکوسیستمها، پژوهشکده علوم محیطی، دانشگاه شهید بهشتی، تهران، ایران.
^۲گروه زیست شناسی دریا، دانشکده علوم زیست شناسی، دانشگاه شهید بهشتی، تهران، ایران.

چکیده: ماهی تیلاپیای آبی، (*Oreochromis aureus* (Steindachner, 1864)) برای اولین بار از رودخانه های اروند و کارون در استان خوزستان گزارش می شود. این گونه دومین ماهی از گروه ماهیان تیلاپیایی است که از ایران گزارش شده و توسط نمونه هایی از پهنه های آبی طبیعی استان خوزستان، تایید شده است. فراوانی نسبی و مناطق حضور تیلاپیای آبی مشاهده شده، در این مقاله ارائه شده است. به دلیل اینکه ماهیان تیلاپیا مقاومت بالایی به شرایط محیطی مختلف داشته و می توانند در زیستگاه های جدید به راحتی گسترش پیدا کنند، بنابراین کنترل و پایش این گونه به شدت توصیه می شود.

کلمات کلیدی: گونه های تیلاپیا، ماهی های غیربومی، تهدیدات، فراوانی نسبی، استان خوزستان.