

## Short Communication

# New habitat and range extension of the Iranian cichlid endemic fish (*Iranocichla hormuzensis*) from the Persian Gulf and Oman Sea basin, Iran

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### Introduction

Cichlids fishes are the second largest Perciformes order (IUCN, 2018), which the actual number of species is unknown, with estimates varying between 2500 - 3000, but at least 1650 species have been scientifically described (CITES, 2017; IUCN, 2020). Also, cichlids have the largest number of endangered species among fish families, most in the Haplochromine group (Nelson et al., 2018). The Haplochromine cichlids are tribe of cichlids in subfamily Pseudocrenilabrinae which are endemic to Africa (Nagl et al., 2000).

In 2010, the International Union for Conservation of Nature (IUCN) classified 184 species as vulnerable, 52 as Endangered (EN), and 106

as Critically Endangered (CR) (IUCN, 2020). At present, the IUCN only lists *Yssichromis* sp. nov. *argens* (Lake Victoria cichlid) classified as a Vulnerable (VU) in Eastern Africa and pan-Africa (Witte et al., 2010), as extinct in the wild (IUCN, 2020), and six species are listed as entirely extinct, (CMS, 2015). Cichlids are particularly well known for having evolved rapidly into many closely related but morphologically diverse species within large lakes, particularly Tanganyika, Victoria, Malawi, and Edward lakes in Africa. Their diversity in the African Great lakes is important for the study of speciation in evolution (Stiassny et al., 2014).

Cichlid fishes have a worldwide distribution and they are found in fresh

and brackish waters of Central and South America, Africa, Madagascar, the Levant, southern India, Sri Lanka and southern Iran. Due to cichlid's economic importance, they are becoming increasingly prominent in freshwater aquaculture, ornamental and behavioral research at many regions of the world (Barluenga *et al.*, 2006; Nelson *et al.*, 2018).

The presence of cichlid species in southern Iran was first noted by Behnke (1975) and Coad (1982); and these fishes were briefly described but not named by Saadati (1977). Coad (1982) described the Iranian cichlids as a new genus and species, *I. hormuzensis*, based on fishes from the Mehran River basin and it was considered as the only cichlid fish of Iran (Esmaili *et al.*, 2010; 2015). Cichlid family and new species of Iranian cichlid is reported the first in Iran with referring to distribution pattern and biological characteristics of *I. hormuzensis* which collected from rivers of the eastern basin of Hormozgan Province (Rabbaniha, 1993, 1994).

There are currently two described species in this genus, but a third population of unclear affinities is known from the Kol River basin (between the ranges of the two recognized species): *Iranocichla hormuzensis* Coad, 1982 and *Iranocichla* sp. nov. *persa* (Esmaili *et al.*, 2016). *I. hormuzensis* also known as the Iranian cichlid belongs to Cichlidae family (Subfamily Pseudocrenilabrinae)

(Esmaili *et al.*, 2016; Froese and Pauly, 2016).

The Persian Gulf zone from the zoogeographic realm point of view is related on pale-arctic region ecosystems (Reynolds, 1999; Valinassab *et al.*, 2006; Owfi *et al.*, 2011). Iranian cichlid endemic fish adapted in freshwater and brackish habitats in the basin of the southern Iran, Persian Gulf and Oman Sea basin, Kol and Mehran Rivers above the Hormuz Strait (Esmaili *et al.*, 2008; Keivani and Daneshvar, 2015; Keivani *et al.*, 2016). Restricted to salty streams, rarely in freshwaters, which are constantly warm, un-shaded, usually with muddy bottoms with little vegetation other than encrusting algae, and are subject to massive flooding during winter rains. Diet consists of various algae (diatoms) and detritus, indicating that it feeds on bottom deposits and by scraping, which have different diet as omnivores, herbivores, planktivores and detritivores (Dadgar *et al.*, 2014; Khoshbakht *et al.*, 2018; Hafeziyeh *et al.*, 2020). Females require a bigger pit size when choosing where to lay eggs (Ghassab Shiran *et al.*, 2013). Differences are seen in the sizes of pits that created, as well as a change in the morphology of the pits (Ghassab Shiran *et al.*, 2013; Khoshbakht *et al.*, 2018).

Restricted range, man-made activities and habitat changes, and over-sampling for research purposes are the main threats to the remaining populations, but *I. hormuzensis* is in

Not Evaluated (NE) and not yet having been assessed by the IUCN (CITES, 2017; IUCN, 2020). This species is the only cichlid endemic to Iran and among the few cichlids in Asia and formerly regarded as the only species in its genus. But another species, *Iranocichla* sp. nov. *Persa* is described from the eastern rivers basins flowing into the Persian Gulf at the Hormuz Strait in the same basin (Esmaeili *et al.*, 2016). Although it seems that in terms of definitive and approved declaration, it should be revised for the independent species as *Iranocichla* sp. nov. *persa*, because considering to the principles of endemism terminology and definitions, it can be similar to different types of endemic taxon such as eu-endemic, micro-endemic, eury-endemic or steno-endemic that are present in a similar or adjacent basin and isolated by geographical and natural barriers (Barluenga *et al.*, 2006). Such a process

can happen through allopatric speciation (Lomolino *et al.*, 2010), whereby species diverge according to different selection pressures in different geographical areas, or through sympatric speciation, by which new species evolve from a common ancestor while remaining in the same area (Owfi *et al.*, 2014; Bhan, 2020).

### Materials and methods

Study area is located in the West of Hormozgan Province, under the Persian Gulf and Oman Sea main basin and following sub-basins (Fig. 1): Subsidiary-1: Kol and Mehran Rivers, southern floodway and islands, Subsidiary-2: South Mehran River, and Subsidiary-3: Tang-e-Khor River and southern coastal floodways (WRSB, 2001; Owfi *et al.*, 2014).

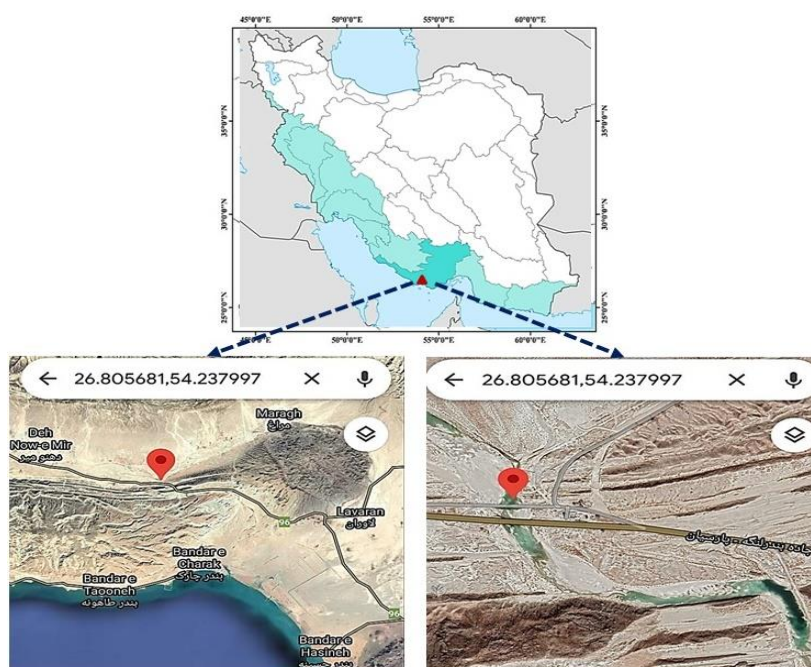


Figure 1: Location and geographical coordinates of the study area (Persian Gulf and Oman Sea basin)

According to the national divisions, the river under study is in Bandar Lengeh and Charak rural district (Hormuzgan Province), and registered with code 2735, in sheet 6843-I (WRSB, 2001;

Owfi *et al.*, 2014; Janparvar and Ghorbani Sepehrm, 2015) This study was carried out during field visits in March 2021 (Fig. 2).



**Figure 2:** Study area in Tang-e-Khor River (Hormuzgan Province) (Left: view to south, Right: view to north)

### Results and discussion

During the field studies the presence of the endemic species of Iranian cichlid, *Iranocichla hormuzensis* Coad, 1982 in the Tang-e-Khor and Charak Rivers (floodway / seasonal rivers) was observed. Based on preliminary studies, the highest nesting density in an area of about 50 m<sup>2</sup> on the southeastern bank of the river with very slow and almost gentle flow with a depth of less than 30 cm, with 35 nests with a diameter of about 30-40 cm and an average distance of about 1 m from each other. Smooth bed without vegetation, with pebbles and scattered rubble was covered with algae (Fig. 3).

Almost all of the nests were occupied by the active presence and territorial behavior of the male (dark color with a distinct black spot on the dorsal fin) which was constructing and designing the nest, with various shapes of continuous lines and dashed lines,

zigzag and were oblique) to attract females and specimens of females (in light color) were also seen around.



**Figure 3:** Nesting pattern of *Iranocichla hormuzensis* males on shallow bed margin of Tang-e-Khor River (Hormuzgan Province)

According to the references and reported documents, geographical distribution patterns of Iranian cichlid limited to Kol and Mehran rivers sub-basin (Hormuzgan). The rivers of this sub-basin leading to the Hormuz Strait and Khoran Creek-Strait, which located in eastern Hormuzgan (Coad, 1982;

Rabbaniha, 1994; Esmaeili *et al.*, 2009, 2010, 2015, 2016; Ghassab Shiran *et al.*, 2013; Froese and Pauly, 2016, 2020).

Therefore, Tang-e-Khor River can be considered as a new and unique habitat in the most southeastern distribution area of geographical distribution pattern of *I. hormuzensis*

The sedimentary regime of the Hormuzgan coasts is mainly controlled by bringing sediments from land and redistributing them at sea (Sheppard *et al.*, 1998; Owfi *et al.*, 2011, 2014). Tang-e-Khor River, like 150 seasonal and floodway rivers is completely flooded and lacks a significant base flow, which has severe changes in the course of the river due to the placement of alluvial sediments in the upstream area, and except in parts of the coastal area, dries up in summer. In the wet season, it joins to the Charak Creek at the confluence with the sea and forms the Creek-floodway habitat, which is an estuary covered with teak shrub (*Tamarix* sp.) and hand-planted Mangrove (*Avicennia marina*) communities.

Unique forms of hydrologic and geomorphologic river structure with two meander patterns and sinusoidal arches with intense erosion effects along the river with a curvature coefficient of more than 1.5 are the dominant land forms. It has been suggested that the floodplain of studied area creek-floodway with sediment particles of fine sand, silt and clay

spread (Shankar and Owfi, 2010; Owfi *et al.*, 2011; Hosseinyarm *et al.*, 2021). Among the most important geology - tectonic features of the region can refer to the active plate and some connected salt domes of the region. This phenomenon causes igneous rocks (mainly alkaline and metamorphic) to reach the depths of the earth, and also for create and build islands formation and other types such as salt marshes, salt plains, playa, coastal terraces rocky shores will play as specific key (Hoseinzadeh *et al.*, 2010; Hosseinyarm *et al.*, 2021). The water of this river is classified in the category of hot sulfur waters with different anions (Mann, 2008). Therefore, considering the passing the river through the Miocene salt formation, the salinity of the water will increase significantly, which will reach its maximum salinity in late spring and summer (Mann, 2008; Owfi and Mirzaei, 2020).

It seems that unlike the northern habitats (Hormuzgan-Fars border area) in Mehran River sub-basin and plains range, the newly identified habitat can be considered as a unique habitat for the present population of Iranian cichlid and other accompanying species (*Aphanius* sp., *Cyprinion* sp. and *Garra* sp.).

Due to the tectonic conditions of the south Zagros region in the study area, as well as land forms as natural barriers in the sub-basin, it is likely that the identified population will have habitat separation. Because it is not possible to

move and migrate along the river or adjacent areas, even in floods condition. Based on field observations, there are several reasons that currently threaten the *I. hormuzensis* population in the area, such as: 1) construction of bridges and height (about 1m.) concrete facades and foundation without stairs in the northern part of the bridge, 2) destruction of the river bank, river bed manipulation and sand harvesting, 3) accumulation of garbage and plastic waste (villagers and travelers), and 4) presence of predators, especially waterfowls species (cormorants, herons and egrets) that were relatively abundant in the area.

So, this issue can be of special interest to ichthyologists and ecologists from the perspective of habitat ecology, bio-geography and behavior patterns (especially in the breeding, nesting and mating season), as well as in terms of planning and implementation of endemic and endangered species conservation plans. This topic should be given priority by the Department of Environment (DoE). However, it is highly taken into consideration that more than usual sampling for laboratory studies should be seriously controlled and is not recommended.

## References

**Barluenga, M., Meyer, A., Muschick, M., Salzburger, W. and Stolting, K.N., 2006.** Sympatric speciation in Nicaraguan Crater lake cichlid fish. *Nature*. 439 (7077), 719–23. DOI:10.1038/nature04325.

**Behnke R.J., 1975.** Fishes from the qanats of Iran. In: 55th Annual Meeting, American Society of Ichthyologists and Herpetologists, Williamsburg, Virginia, 8-14 June 1975,75.

**Bhan, P., 2020.** Endemics: types, characters and theories. <https://www.biologydiscussion.com>.

**CITES, 2017.** The Checklist of CITES species website. Appendices I, II and III valid from 04 October 2017. CITES Secretariat. Geneva, Switzerland.

**CMS, 2015.** Appendices I and II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

**Coad, B.W., 1982.** A new genus and species of cichlid endemic to southern Iran. *Copeia*, 1982(1), 28-37. DOI:10.2307/1444264

**Dadgar, S., Marjani, M., Khiyabani, A., Sharifiyan, M. and Hoseinzadeh Sahafi, H., 2014.** Introduction to the Iranian cichlid, *Iranocichla hormuzensis* as an endemic and unique species for aquarium – Hormuzgan Province inland waters. *Aquaculture Development Journal* (in Persian), 2(8), 83-87.

**Esmaeili, H.R., Ganjali, Z. and Monsefi, M., 2008.** Reproductive biology of the endemic Iranian cichlid, *Iranocichla hormuzensis* Coad, 1982 from Mehran River, southern Iran. *Environmental Biology of Fishes*, 84(141), 361–389. DOI:10.1007/s10641-008-9397-8).

- Esmaeili, H.R., Coad B.W., Gholamifard, A., Nazari, N. and Teimory, A., 2010.** Annotated checklist of the freshwater fishes of Iran. *Zoo Systematica Rossica*, 19, 361–386. DOI:10.31610/zsr/2010.19.2.361).
- Esmaeili, H.R., Khajepana, A., Mehraban, A., Elmi, A., Melekzei, H. and Pazira, A., 2015.** Fishes of the Mashkid and Makran basins of Iran: an updated checklist and ichthyo-geography. *Iranian Journal of Ichthyology*, 2, 113–132.
- Esmaeili, H. R., Sayyadzadeh, G. and Seehausen, O., 2016.** *Iranocichla persa*, a new cichlid species from southern Iran (Teleostei, Cichlidae). *Zoo Keys*, 636, 141–161. DOI:10.3897/zookeys.636.10571).
- Froese, R. and Pauly, D., 2016.** *Iranocichla hormuzensis* in FishBase. October 2016 version. FishBase.com.
- Froese, R. and Pauly, D., 2020.** List of Nominal Species of Cichlidae in FishBase. February 2020 version. FishBase.com.
- Ghassab Shiran, Z., Dorafshan, S. and Keivany, Y., 2013.** Population genetic structure of Iranian cichlid, *Iranocichla hormuzensis* as an only Cichlidae family in Iran using microsatellite markers. *Taxonomy and Bio-Systematic Journal* (in Persian), 5(14), 9-16.
- Hafeziyeh, M., Seydgar, M., Ghaedim A., Mohamadi, M. and Abkenar, A.M., 2020.** Use of *Azolla filiculoides* of Anzali Wetland as a source of plant protein in feeding Iranian ornamental cichlid, *Iranocichla hormuzensis*. *Fish Animal Environment Research Journal* (in Persian), 1(12), 331-338.
- Hoseinzadeh, M.M., Nohegae, A., Sadigh, H. and Gholami, A., 2010.** Assessing of geomorphologic changes of Mehran River on delta using remote sensing and GIS (Hormuzgan Province, Bandar Lengeh), *Environmental Erosion Research Journal* (in Persian), 2, 53-69.
- Hosseinyarm, G., Behbahani, M.R., Moussavi Harami, R., Lak, R. and Kuijpers, A., 2021.** Holocene sea-level changes of the Persian Gulf. *Quaternary International*, 571, 26-45. DOI:10.1016/j.quaint.2020.11.051
- IUCN, 2018.** The IUCN Red List of Threatened Species. Version 2018.4.
- IUCN, 2020.** The IUCN Red List of Threatened Species. Version 2020-2.
- Janparvar, M. and Ghorbani Sepehrm, A., 2015.** Sustainable geo-tourism and eco-tourism of Hormuzgan Province. *Persian Gulf Cultural and Political Studies Quarterly Journal* (in Persian), 1, 111-133.
- Keivany, Y. and Daneshvar, E., 2015.** Reproduction of an isolated Iranian cichlid, *Iranocichla hormuzensis*. *Caspian Journal of Environmental Science*, 13(2), 119-128.
- Keivani, Y., Nasri, M., Abbasi, K. and Abdoli, A., 2016.** Atlas of

- inland freshwater fishes of Iran, Department of Environment (DoE), Tehran, Iran.
- Khoshbakht, B., Ebrahimi, S., Saffaei, M. and Kamali, E., 2018.** Study on Iranian cichlid, *Iranocichla hormuzensis* diet in Kol River – Hormuzgan Province. *Animal Environment Research Journal* (in Persian), 2 (10), 323-330.
- Lomolino, M.V., Riddle, B.R., Whittaker, R.J. and Brown, J.H., 2010.** Bio-geography. Sinauer Associates, Inc., Sunderland (Massachusetts).
- Mann, K.H., 2008.** Ecology of coastal waters. Belford Institute of Oceanography, Blackwell Scientific Pub., Canada.
- Nagl, S., Tichy, H., Mayer, W.E., Takezaki, N., Takahata N. and Klein, J., 2000.** The origin and age of Haplochromine fishes in Lake Victoria, east Africa. *Proceedings: Biological Sciences*, 267, 1447. DOI: 10.1098/rspb.2000.1109.
- Nelson, J. S., Grande, T.C. and Wilson, M. V. H., 2018.** Fishes of the World. Wiley Pub. Co., USA.
- Owfi, F., Ansari, Z., Rahimi, M. and Toosi, M., 2011.** Ecological classification of intertidal habitats (Iranian coasts of the Persian Gulf & Oman Sea) using by CMECS model, INOC XI International Symposium of Coastal Zone Challenges, Bogor, Indonesia.
- Owfi, F., Rabbaniha, M. and Ramin, M., 2014.** Indicator and sentinel species geographical distribution of Iranian coastal zone for ICZM - EMP by GIS, INOC-IMST International Conference on Integrated Coastal Zone Management, Izmir-Turkey.
- Owfi, F. and Mirzaei, M.R., 2020.** Investigation of the emergence of marine volcanoes in the coastal waters of the Gulf of Oman (Makran region) from the perspective of fisheries and environment – Scientific Report, Iranian Fisheries Science Research Institute (IFSRI), Tehran, Iran.
- Rabbaniha, M., 1993.** Introduction to the Cichlidae. *Abzayan Magazine* (in Persian), 5(5), 22-27.
- Rabbaniha, M., 1994.** Introduction to the Iranian cichlid, *Iranocichla hormuzensis*. *Abzayan Magazine* (in Persian), 5(6), 17-23.
- Reynolds, M., 1999.** Physical oceanography of the Persian Gulf, Strait of Hormuz, and the Gulf of Oman - Results from the Mt. Mitchell expedition., Brookhaven National Laboratory, Marine Pollution Bulletin, Pergamon Press, London.
- Saadati, M.A.G., 1977.** Taxonomy and distribution of the freshwater fishes of Iran. M.Sc. Thesis, Colorado State University, Fort Collins, Colorado.
- Shankar, D. and Owfi, F., 2010.** Dynamics of large-scale wind-driven circulation off the Indian Ocean coast, National Institute of Oceanography (NIO) – Scientific Report. Goa- India.



- Sheppard, C., Price, A. and Roberts, C., 1998.** Marine ecology of the Arabian region (patterns and processes in extreme tropical environment. Cambridge University, London, UK.
- Stiassny, M., Teugels, G.G. and Hopkins, C.D., 2014.** The fresh and brackish water fishes of west-central Africa – Vol. 2. Musée Royal de Afrique Centrale.
- Valinassab, T., Daryanavbard, G.R., Dehghani, R. and Pierce, G., 2006.** Abundance of demersal fish resources in the Persian Gulf and Oman Sea. *Journal of Marine Biological Associations of United Kingdom (JMBA)*. 86(5141), 1-8. DOI:10.1017/S0025315406014512.
- Water Resources Study Bureau (WRSB), 2001.** Classification and coding of Iran basins – Annual Report. Energy Ministry – Iran Water Resources Management Office. Tehran, Iran.
- Witte, F., de Zeeuw, M.P. and Brooks, E., 2010.** *Haplochromis argens*. The IUCN Red List of Threatened Species 2010: e.T185840A8489051.