

The Fish Fauna of North and East Regions of Khorasan-e-Razavi Province, Iran

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Khorasan-e-Razavi province in the northeast of Iran possesses varied climatic and geographical conditions that lead to a rich biodiversity. An investigation on the status of the fish fauna was carried out from March to October 2013. A total of 401 specimens was collected and identified, from 30 localities among seven counties in this province. Sampling was performed using hand net, cast net and electrofishing equipment. The collected specimens represented two families, seven genera and nine species including Cyprinidae (*Capoeta capoeta*, *Capoeta fusca*, *Schizothorax pelzami*, *Alburnoides eichwaldii*, *Squalius cephalus*, *Garra rossica*, *Pseudorasbora parva*) and Nemacheilidae (*Paraschistura cristata* and *Paraschistura turkmenica*). The Cyprinidae with seven species, showed the highest diversity among the families represented here.

Key words: Khorasan-e-Razavi province, fauna, fish, Iran.

INTRODUCTION

It is important to survey fishes in aquatic ecosystems for several reasons, such as identification, evolutionary review, ecology, ethology, conservation, water resources management, exploitation of reserves and pisciculture. The confirmed freshwater ichthyofauna of Iran is represented by 202 species in 104 genera, 28 families, 17 orders and 3 classes, found in 19 different basins. (Esmaili et al, 2010). The most diverse order is the Cypriniformes with 120 confirmed species (59.4%), followed by Cyprinidae with 93 confirmed species (46.0%), Nemacheilidae with 22 species (10.9%) and Cobitidae with five species (2.5%) (Esmaili et al, 2010). However, a few new and exotic fishes have been recently reported from inland waters of Iran, increasing the number of confirmed species to more than 220 (Esmaili et al, 2013; Teimori et al, 2014). Several studies have been done on the ichthyofauna in Iran, over the last few decades. Some investigations on the status of fish fauna of Khorasan-e-Razavi province were conducted by Abdoli et al (1999) and (2007), Badiei (2002), and Zareian et al. (2013).

Khorasan-e-Razavi is one of the 31 provinces of Iran; located in north-eastern part of the country and covers an area of 144,681 km². It borders North Khorasan province and Turkmenistan in the north, Semnan province in the west, South Khorasan province in the south and Afghanistan and Turkmenistan in the east. In terms of its geographical location, this province is divided into northern and southern areas. The northern area is covered with fertile plains while the southern one consists

of desert plains and low hills covered with poor vegetation. Climatologically, Khorasan-e-Razavi province has different conditions in different areas. For example, the northern part contains mountains with a semiarid condition, such as Hezar-Masdjed and Binaloud mountains, while the southern part which is mostly flat has a warm and dry climate. Due to its geographical location and mostly warm and dry climate, this region has mostly been neglected from the standpoint of ichthyofauna studies. Consequently, in order to address the lack of information on the fish fauna of Khorasan-e-Razavi province, the current research is focused on the mentioned area to determine fish species of this region.

MATERIALS AND METHODS

The study area is located in northeastern Iran between 36°24' to 37°05' N and 58°30' to 61°07' E. The altitude ranges from 229m (Sarakhs plain) to 3615m (Binaloud peak) above sea level (www.khorasan.ir). The annual precipitation varies from 133mm in Bardaskan County to more than 320 mm in Kalat-e-Naderi county (www.razavimet.gov.ir). The field work was carried out from March to October 2013. Specimens were caught by electro fishing gear and dip net. The locality data and habitat features were recorded for all the studied species. The tissue and fin samples of specimens were preserved in 95-99.9% ethanol for molecular study and whole specimens were fixed in 5-10% formalin. The voucher specimens are deposited in the Zoological Museum of the Ferdowsi University of Mashhad (ZMFUM). Specimens were identified according to Abdoli (2000), Coad (2015) and Freyhof et al. (2015) identification keys.

Ten meristic characters were recorded including, Dorsal fin ray (D1), Anal fin ray (A1), Ventral fin ray (V1), Lateral line scales (LLS), Pre dorsal scale row (PDSR), Upper transverse (UT), Scale from lateral line to pelvic fin origin (SLPO), Lower transverse scale row (LTS), Circum-peduncular scale row (CSR). Also twenty conventional morphometric characters were measured for individual specimens, using digital Vernier calipers. Measurements included total length (TL), standard length (SL), head length (HL), snout length (SNL), eye diameter (ED), body depth (BD), dorsal-fin length (DFL), pectoral-fin length (PFL), anal-fin length (AFL), ventral-fin length (VFL), caudal-peduncle depth (CPD), caudal-peduncle depth maximum (CPDM), predorsal distance (PDD), prepectoral distance (PPD), preventral distance (PVD), preanal distance (PAD), occipital origin to ventral fin (OTV), occipital origin to anal fin (OTA), dorsal origin to pectoral fin (DOP), and occipital origin to pectoral fin (OTP).

RESULTS

A total of 401 specimens were collected from the study area wherein nine species belonging to seven genera and two families (Table 1). The distribution map of the studied species and their photos are presented in Figure 1 and Figure 2. The biggest individual belonged to *Squalius cephalus* while the smallest was from *Paraschistura turcmunica*. Univariate analysis of variance (ANOVA) showed significant differences with varying degrees between the means of all samples of standardized morphometric measurements ($P < 0.005$).

Family Cyprinidae

Subfamily Cyprininae

Capoeta capoeta (Güldenstädt, 1773)

30 specimens.

Distribution: Asia: eastern Turkey and southern Caspian Sea watersheds.

Distribution in Iran: *Capoeta capoeta* is known from Tedzhen or Harirud basin of Iran and eastwards including the Kashaf River.

Morphology: Dorsal fin with 4 unbranched rays and 7(9) or 8(21) branched rays, anal fin with 3 unbranched rays and 5(8) or 6(22) branched rays, pectoral fin branched rays 14(15), 15(3), 17(12), pelvic fin branched rays 7(23), 8(7). Lateral line scales 36-52. Maximum Total Length (TL) of an adult measured 114.19mm and Standard Length (SL) measured 96.02mm. Maximum Body Depth (MaBD) of an adult measured 22.69mm and Minimum Body Depth (MiBD) measured 10.62mm (Figure 2a).

***Capoeta fusca* Nikolskii, 1897**

43 specimens.

Distribution: Asia: eastern Iran, western Afghanistan.

Distribution in Iran: Its distribution encompasses much of eastern Iran (Tedzhen, Bedjestan, Sistan, Kavir and Lut basins; Ghorrghoori, Asafshad, Mardan Shah, Gazdmoo and Afir rivers), western Afghanistan (Nikolskii, 1899; Berg, 1949; Abdoli, 2000).

Morphology: Dorsal fin with three unbranched rays and 7(18) or 8(25) branched rays, anal fin with 3 unbranched rays and 5(43) branched rays, pectoral fin with 14(5), 15(25), 16(5) or 20(7) branched rays, pelvic fin with 7(32) or 9(11) branched rays. Lateral line scales 40-56. Scales are found regularly arranged over the whole body and are enlarged around the anus and anal fin base (Coad, 2015). Maximum Total Length (TL) of an adult measured 183.73mm and Maximum Standard Length (SL) measured 159.07mm. Maximum Body Depth (MaBD) measured 38.02mm and Minimum Body Depth (MiBD) measured 17.41mm (Figure 2b).

***Schizothorax pelzami* Kessler, 1870**

31 specimens.

Distribution: Central Asia.

Distribution in Iran: *Schizothorax pelzami* (Transcaspian Marinka) is found in the Murgab and Tedzhen rivers of Turkmenistan and Afghanistan including Iranian drainages of the former known as the Hari River in its Iranian reach (Aliev et al, 1988) and distributed in springs, streams, rivers and qanats (Coad, 2015). *Schizothorax pelzami* is distributed in Tedzhen River and Kavir basin in Iran (Esmacili et al. 2010).

Morphology: dorsal fin branched rays 7(11) or 8(20); anal fin branched rays 5(31); pectoral fin branched rays 16(2), 17(4), 18(12), or 20(15); pelvic fin branched rays 7(2), 8(27) or 9(2); lateral line scales 85-100. Maximum Total Length (TL) of an adult measured 155.29mm and Maximum Standard Length (SL) measured 135.68mm. Maximum Body Depth (MaBD) measured 28.77mm and Minimum Body Depth (MiBD) measured 14.09mm (Figure 2c).

***Alburnoides eichwaldii* (De Filippi, 1863)**

Distribution: Eurasia.

Distribution in Iran: It is distributed in many rivers and streams of Iran, such as Kura River, Caspian Sea basin

15 specimens.

Morphology: Branched anal fin rays 8(5), 9(9) and 1(9); branched dorsal fin rays 7(14), 8(1) Dorsal fin with 7(14) or 8(1) branched rays, anal fin with 8(10) or 11(5) branched rays, pectoral fin with 14(5), 15(5), 16(5) branched rays, pelvic fin with 7(10) or 8(5) branched rays. Maximum Total Length (MTL) of an adult measured 92.59mm. Standard Length (SL) measured 76.72mm. Maximum Body Depth (MaBD) measured 22.74mm, Minimum Body Depth (MiBD) measured 7.53mm and Maximum Lateral Line Scales (LLS) about 54mm (Figure 2d). The species-level taxonomy of the members of the genus remains to be settled (Turan et al 2014). *Alburnoides eichwaldii* is distributed in small streams and rivers of Iran (Esmacili et al. 2010; Coad, 2015).

Subfamily Leuciscinae***Squalius cephalus* (Linnaeus, 1758)****26 specimens.****Distribution:** Europe and Asia Minor.**Distribution in Iran:** It is distributed in some basins including the Caspian Sea, Lake Urmia, Namak Lake and Tigris River (Esmacili et al. 2010)**Morphology:** Dorsal fin branched rays 7(10), 8(12, after 2(6), usually three, unbranched rays, anal fin branched rays 7(4), 10 (16) and 8(6) after three unbranched rays, pectoral fin branched rays 14(5), 16(4), 18(12) and 19(5), and pelvic fin branched rays 6(5), 8(4), and 9(17). Lateral line scales 38-48. Maximum Total Length (TL) measured 194.41mm and Maximum Standard Length (SL) measured 164.89mm (Figure 1e). Maximum Body Depth (MaBD) measured 44.15mm and Minimum Body Depth (MiBD) measured 19.46mm (Figure 2e).**Subfamily Gobioninae*****Pseudorasbora parva* (Temminck & Schlegel, 1846)****10 specimens****Distribution:** Northeastern Asia.**Distribution in Iran:** It is an introduced fish to the Caspian Sea, Namak Lake, Tedzhen River, Sistan, Maharlou, Urmia, Gulf and Tigris River basins and probably elsewhere (Esmacili et al. 2015).**Morphology:** Dorsal fin unbranched rays 3 followed by 7(5) and 8(7) branched rays, anal fin with 2(1) and 3(9) unbranched rays and 5(7) and 7(3) branched rays. Pectoral fin branched rays 11-14, and pelvic fin branched rays 6(5), 7(3) and 8(2). Lateral line scales 30-40, with the lateral line rarely incomplete. A pelvic axillary scale is present (Figure 2i). The fish's size is rarely above 8 cm and usually 2 to 7.5 cm long.**Subfamily Labeoninae*****Garra rossica* (Nikolskii, 1900)****18 specimens****Distribution:** Asia: Iran, Afghanistan and Pakistan**Distribution in Iran:** It is widely distributed in eastern Iran (Coad, 2015).**Morphology:** Dorsal fin branched rays 6(10) and 7(8), anal fin branched rays 5 (18), pectoral fin branched rays 11(2), 12(4), 13(4), 14(5), and 16(3); pelvic fin branched rays 7(9) and 8(11); lateral line scales 34-38. Maximum Total Length (TL) of and adult measured 80.7mm and Maximum Standard Length (SL) measured 68.68mm. Maximum Body Depth (MaBD) measured 13.28mm and Minimum Body Depth (MiBD) measured 7.08mm (Figure 2h).**Family Nemacheilidae*****Paraschistura turcmunica* (Berg, 1932)****100 specimens.****Distribution:** *Paraschistura turcmunica* is known from rivers flowing in the eastern Kavir basin and towards the western Karakum desert: the Hari in Afghanistan, Iran and Turkmenistan, the Murgab in Afghanistan and Turkmenistan and the streams of the northern slope of Kopetdag in Turkmenistan (Freyhof et al. 2015).**Morphology:** Dorsal fin with 2-5 unbranched and 6-8 branched rays, anal fin with 2-3 unbranched and 4-6, usually 5, branched rays, pectoral fin branched rays 7-10, and pelvic fin branched rays 6-7). Maximum Total Length (TL) measured 50.77mm and Maximum Standard Length (SL) measured 39.76mm. Maximum Body Depth (MaBD) measured 5.6mm and Minimum Body Depth (MiBD) measured 3.67mm (Figure 2f).

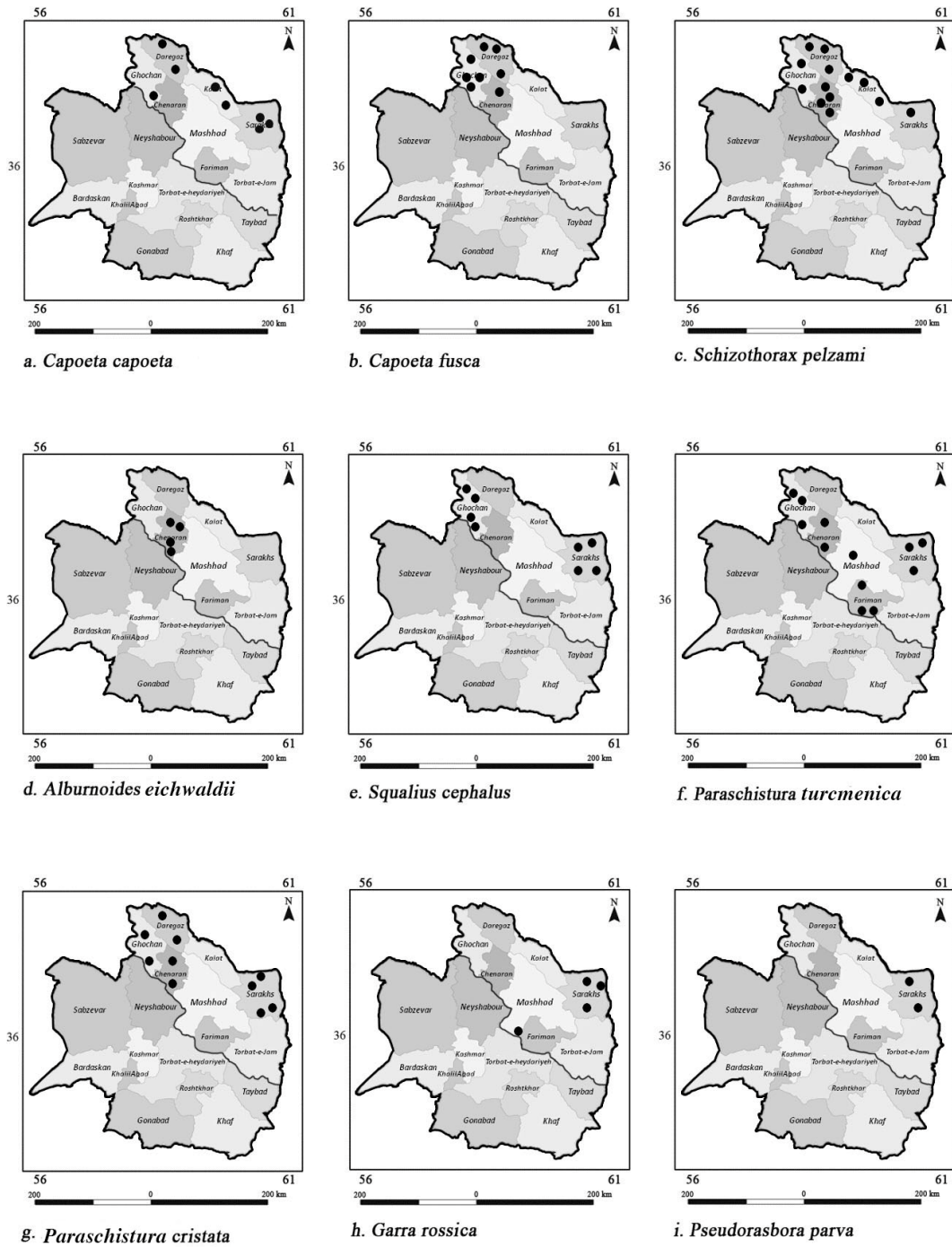


FIGURE 1. Distribution of species in the study area.

Paraschistura cristata* (Berg, 1898)*128 specimens.**

Distribution: *Paraschistura cristata* is known from the Hari drainage in Afghanistan, Iran and Turkmenistan as well as from streams flowing down from the Kopedag to the Karakum desert in Turkmenistan.

Distribution in Iran: This species is reported throughout the Hari river basin and in the Tedzhen basin (Esmacili et al. 2015). This species is confirmed to be from Sarakhs on the Hari Rud, and probably the Kashaf River, a Hari River tributary (Abdoli, 2000).

Morphology: Dorsal fin branched rays 8(2) 7(140), anal fin branched rays 5(4), pectoral fin branched rays 8(2), 9(2), 10(1) or 11(1); pelvic fin branched rays 7(4) 9(1), 6(1) or 11(1). Maximum Total Length (TL) of and adult measured 80.7mm and Maximum Standard Length (SL) measured 68.68mm. Maximum Body Depth (MaBD) measured 13.28mm and Minimum Body Depth (MiBD) measured 7.08mm (Figure 2g).

DISCUSSION

The current study recorded nine species of fishes belonging to seven genera and two families of Cyprinidae and Nemachelidae. A high diversity of genus and species was found for the Cyprinidae family.

The genus *Capoeta* that belongs to the cyprinidae family bears 24 valid species (Froese & Pauly, 2012), of which seven species are distributed in Iran. *Capoeta capoeta* collected in this study can be distinguished by its two pairs of barbells in comparison with one pair in other subspecies. Esmacili, et al (2010) and Reshetnikov and Shakirova (1993) recognized *Capoeta capoeta heratensis* as a full species. *C. c. heratensis* shows major variations in body form, sometimes called morpha *elata* with a deep body and morpha *elongata* with a shallow and elongated body. These are not taxonomically significant but simply ecomorphs and all intermediates between the two extremes can be found. The deep-bodied form probably formed part of the fishes described as *asmussii* (Berg, 1948-1949). *Capoeta capoeta heratensis* is not a valid species name any longer. This is now incorporated into the *Capoeta capoeta* complex. Therefore, the obtained results for this sub-species are invalid without molecular confirmation and cannot be published.

The spiralin, *Alburnoides bipunctatus* (Bloch, 1782) is characterized by small black spots near the pores located on each side of the lateral line outlining the canal at least along its anterior portion (Bogutskaya and Coad 2009). Ten subspecies and local forms were described or reported within the *Alburnoides bipunctatus* complex. Some of the subspecies were recently given a rank of species. *Alburnoides eichwaldii* was a subspecies of *Alburnoides bipunctatus* but it was raised to species level by Bogutskaya and Coad (2009). However, taxonomic problems persist because most of the earlier investigations were solely based on classical techniques. A synthesis of classical techniques with recent morphometric and molecular studies may provide a solution to the Cyprinid taxonomic problem, particularly among the *Alburnoides* complex.

Northeastern Iran is a habitat for several native fish species. However, a great number of taxa remains to be described. Most of the collected species are native to the north and east regions of Khorasan-e-Razavi province, but only one species, *Pseudorasbora parva* from aquaculture farms, have been introduced to this region that are exotic species. *Pseudorasbora parva* (Stone moroko), is native to Asia. The phenotype of this species is highly influenced by environmental conditions and this is suggested to be one of the attributes that makes this fish a successful invasive species Today, the most compelling fish invasion in the world is arguably the accidental introduction of the *Pseudorasbora parva*, a small freshwater cyprinid species originating from East Asia, with 32 countries invaded from Central Asia to North Africa in less than 50 years. (Gozlan et al. 2002). This invasion has a gradually negative and decremental effect on the endemic fishes of this and other regions.

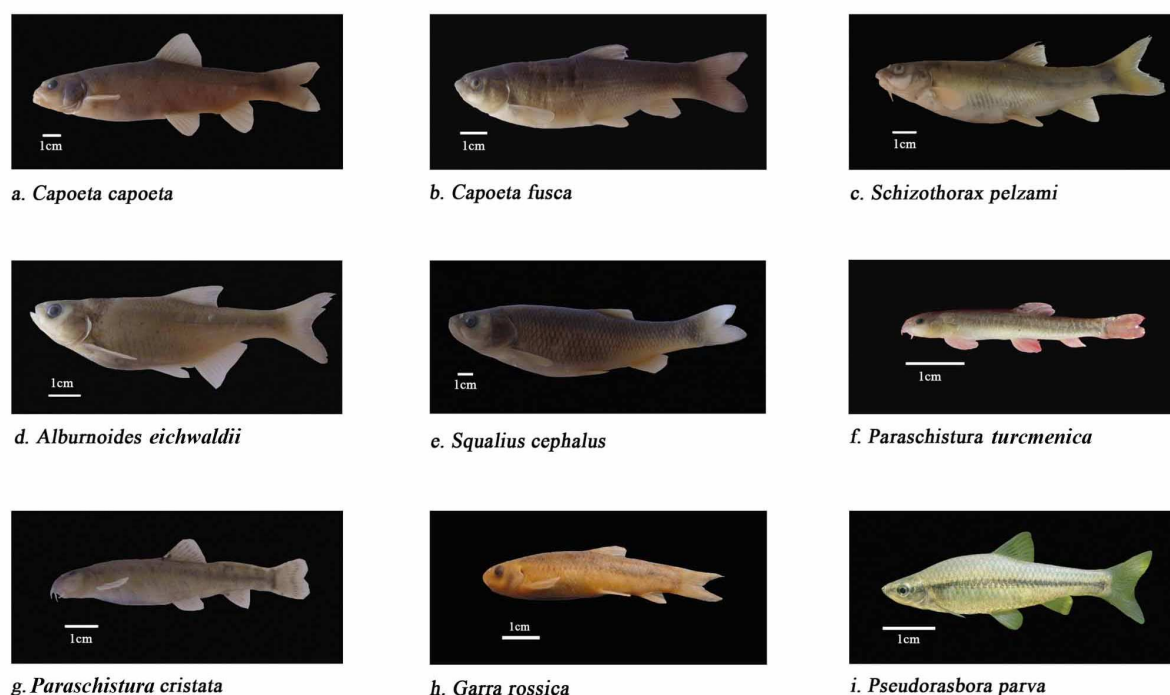


FIGURE 2. Habitus of the examined species.

TABLE 1. Fish species collected from north and east regions of Khorasan-e- Razavi province

No	Species	Common Name	statue	Family
1	<i>Paraschistura cristata</i>	Turkmenian Crested Loach	native	Nemacheilidae
2	<i>Paraschistura turkmenica</i>	Sarhadd Loach	native	Nemacheilidae
3	<i>Alburnoides eichwaldii</i>	Bleak	native	Cyprinidae
4	<i>Capoeta capoeta beratensis</i>	Transcaspian Khramulya	native	Cyprinidae
5	<i>Capoeta fusca</i>	Siah Mahi	native	Cyprinidae
6	<i>Schizothorax pelzami</i>	Transcaspian Marinka	native	Cyprinidae
7	<i>Squalius cephalus</i>	Chub	native	Cyprinidae
8	<i>Garra rossica</i>	Rossharbe	native	Cyprinidae
9	<i>Pseudorasbora parva</i>	Stone Moroko	Introduced	Cyprinidae

Nemacheilid loaches of the genus *Paraschistura* are a group of poorly known species; therefore, not all of its species are fully examined and ascribed to it or related genera (Coad, 2014 and Kottelat, 2012). The genus was only recently described by Prokofiev (2009), and subsequently Kottelat (2012) listed 14 species in *Paraschistura*, based mostly on the proposals of Prokofiev (2009). *Paraschistura cristata* is distinguished from the other species of *Paraschistura* in Iran by having a prominent dorsal adipose crest supported by 22-25 procurrent rays of the caudal fin, a complete lateral line and the large size of adults, usually reaching 70 mm SL. Lateral line complete, reaching to caudal-fin base; caudal peduncle with a prominent dorsal adipose crest supported by 22-25 procurrent caudal-fin rays Freyhof et al (2015). *P. turkmenicus* described from Turkmenistan suggested a synonym of *P. sargadensis* (Berg 1948-1949) but Bănărescu and Nalbant (1966) consider it to be a valid subspecies (Vatandoost and Igdari 2015). Freyhof et al (2015) have given precedence to *Paraschistura* over *Metaschistura*. *Metaschistura* is, thus, a subjective junior synonym of *Paraschistura* (Freyhof et al., 2012). *Paraschistura* is currently diagnosed by just a number of osteological characters in Iran. However, the

application of non-morphological methods, such as cytogenetic and molecular studies, may provide a complementary data source for a more accurate and precise identification of *Paraschistura* species. Systematic studies, for most species of ichthyofauna of Khorasan-e-Razavi province, of the population, species, and subspecies levels have not yet been completed, and requires systematic investigation using both molecular and morphological data. The biology of most species is unknown (Coad, 2015 and Abdoli et al., 2011). To ensure survival of many rare and endangered species, long-term research will be needed. Detailed survey, exploration and more accurate identification, occurrence and distribution of fishes in the streams of main rivers are much needed for this region. Industrial, agricultural and aquaculture pollutants, as the main sources of water pollution, have significantly increased in Khorasan-e-Razavi province. Since some of the fish species collected in this province are considered endemic, special attention should be paid to their conservation.

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