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RESEARCH PAPER

# Biodiversity of Fishes in Sulaimani Province in Kurdistan Region, Iraq

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**A B S T R A C T:**
During the current study, random samples of fishes were taken from 26 localities mostly in the Lesser Zab and Sirwan tributaries within Sulaimani Province, Kurdistan Region, Iraq to survey the biodiversity of fish that are naturally found in water bodies of this province. The study was carried out during the period from January to the end of December 2018. A total of 2100 freshwater fishes, belonging to 35 species and eight families were collected. Among these fish species four native species are globally vulnerable. The study also demonstrated that *Cyprinion macrostomum* was the most abundant and wide spread species in this province, while *Leuciscus vorax* was scarce.

KEY WORDS: Freshwater fish, Biodiversity, Native species, Exotic species, Sulaimani province.
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## 1. INTRODUCTION

The first taxonomic studies of ichthyofauna in Iraq started with Heckel 1843 in 19th century. He described 17 species from Tigris River at Mosul City in northern Iraq (Jawad, 2012; Kaya *et al.* 2016). There are a few works on ichthyofauna in Kurdistan Region of Iraq including the study of ichthyofauna in Dokan and Derbandikhan Lakes by Ciepielewski *et al.* (2001), Abdullah (2006), Abdullah *et al*. (2007), Abdullah and Abdullah (2018). The knowledge concerning the fish fauna of Kurdistan Region of Iraq is limited to fish parasitic studies carried out by Abdullah and Rasheed (2004a; 2004b), Abdullah (2005), Abdullah and Abdullah (2013a; 2013b; 2015a; 2015b; 2016; Bilal *et al.*, 2017).

Recently new fish species are being described from this Region. For instance, Freyhof *et al.* (2014) described two new species *Paracobitis molavii* in Zalm stream in Sulaimani province and *Paracobitis zabgawraensis* in Rean stream near Ziraran in Erbil province. Freyhof *et al*. (2016) recorded *Eidinemacheilus proudlovei* a subterranean loach from an aquifer into an ephemeral spring flowed into a small stream, which belongs to the Tabeen drainage in Sulamani province. Freyhof and Abdullah (2017) recorded two new loaches *Oxynoemacheilus gyndes* and *O.*

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*hanae* in headwater streams of the upper Sirwan in Sulamani province. Also, Freyhof and Geiger (2017) recorded *Oxynoemacheilus zarzianus* in a spring fed stream in the Qalachulan River drainage in Sulamani province. In this investigation, we have summarized the available information on the biodiversity of fishes in Sulaimany Province that were collected in one year alone and ranging from smallest to largest fish size. Apparently, the existing information is incomplete and future studies are required in detail for a complete inventory and assessment of the biodiversity of fishes in this rich watery Province.

The aim of the present study is to currently identify the diversity of fish fauna within water bodies in Sulaimani Province, there is no scientific survey on fish fauna of these water bodies in this area.

## 2. MATERIALS AND METHODS

### 2.1. Description of Study Area:

Sulaimani province (Fig. 1) is located in the northeast of Iraq. It is situated between the latitudes of $35^0$ 05' and $36^0$ 30' and between longitudes of '$44^0$ 25' and $46^0$ 20'**.** It is located close to the Iraqi-Iranian border. There are many water bodies in this province in addition to the two large rivers, namely, the Lesser Zab and Sirwan Rivers which they pass through this Province. The sampling area divided into eight area and 26 localities (Table 1).

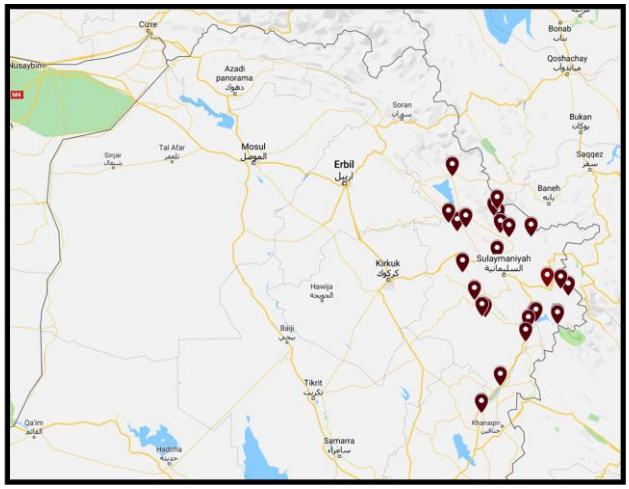


**Figure 1:** Map of north Iraq showing the study area (Google map 2019).

**Table (1)** List of sampling locations and their geographical specification.

| Area | Localities | Coordinates |
|---|---|---|
| **Sulaimani city** | Sarchnar | N $35.586029^0$<br>E $45.381129^0$ |
| **Sharbazher** | Awkurte | N $35.964140^0$<br>E $45.396998^0$ |
| | Bardbard | N $35.915020^0$<br>E $45.367732^0$ |
| | Kareza | N $35.78366^0$<br>E $45.418174^0$ |
| | Khewata | N $35.75105^0$<br>E $45.7062^0$ |
| | Kunamasi | N $35.79695^0$<br>E $45.41370^0$ |
| | Qashan | N $35.867406^0$<br>E $45.403254^0$ |
| | Wazha | N $35.750105^0$<br>E $45.496155^0$ |
| **Sharazwr** | Darbandikhan lake | N $35.11315^0$<br>E $45.70650^0$ |
| | Kawta | N $35.095823^0$<br>E $45.92079^0$ |
| | Reeshen | N $35.354654^0$<br>E $45.961988^0$ |
| | Saraw | N $35.3722^0$<br>E $45.8351^0$ |
| | Shameran | N $35.117285^0$<br>E $45.719307^0$ |
| | Taparezina | N $35.30135^0$<br>E $46.0284^0$ |
| | Zmkan | N $35.089628^0$<br>E $45.918118^0$ |
| **Qaradagh** | Astely Ashty | N $35.1634^0$<br>E $45.2600^0$ |
| | Hazar Kani | N $35.1713^0$<br>E $45.2252^0$ |
| **Garmyan** | Banikhelan | N $35.063475^0$<br>E $45.648604^0$ |
| | Kalar | N $34.649567^0$<br>E $45.379714^0$ |
| | Kulajo | N $34.452221^0$<br>E $45.197145^0$ |
| | Sangaw | N $35.292413^0$<br>E $45.160485^0$ |
| **Bazyan** | Basara | N $35.5001^0$<br>E $45.0621^0$ |
| **Dukan** | Chami Rezan | N $35.8084^0$<br>E $45.021689^0$ |
| | Swrqawshan | N $35.872773^0$<br>E $44.944338^0$ |
| | Tabin | N $35.8336^0$<br>E $45.104544^0$ |
| **Ranya** | Darbany Ranya | N $36.216218^0$<br>E $44.99143^0$ |

### 2.2. Collection and Preservation of Fishes

Fishes were mostly caught by pulsed DC electro-shock device (SAMUS 1000). The device was set up as follow: frequency of output pulses 50 Hz, duration of output pulses 5 milliseconds, amplitude of the output pulses 320V, output power 220W . This device just anesthetizes the fishes for a few seconds without harming the fishes or other water creatures. Also, gill netting, and hook were used. After anesthesia, fishes were fixed in 5% formaldehyde and stored in 70% ethanol. The fishes were identified based on their morphometric and meristic characters, so the measurements made point to point never by projections according to Beckman (1962), Kottelat and Freyhof (2007), and Coad (2010) and the scientific names for fishes were identified according to Froese and Pauly (2019).

## 3. Results and Discussion

A total of 2100 freshwater fish were collected from different water bodies in Sulaimani Province during the period from January to the end of December 2018. Table (2) shows number of fish species in different families, their abundance in this area and status. The fish fauna of this area comprise 35 species in 25 genera and eight families. The most diverse family is Cyprinidae with 23 species (65.7%) followed by Nemacheilidae with 6 species (17.1%), Bagridae, Heteropneustidae, Mastacembelidae, Mugilidae, Siluridae and Sisoridae each with only one species (2.8%).

The native species comprised 30 species (85.7%) in 7 families namely *Alburnus caeruleus, Acanthobrama marmid, Alburnus mossulensis, Arabibarbus grypus, Barbus lacerta, Capoeta trutta, C. umbla, Carasobarbus kosswigi, C. luteus, Chondrostoma regium, Cyprinion kais, C. macrostomum, Garra rufa, Leuciscus vorax, Luciobarbus barbulus, L. esocinus, L. xanthopterus, Squalius cephalus* and *S. lepidus* (Family Cyprinidae), *Mystus pelusius* (Bagridae), *Mastacembelus mastacembelus* (Mastacembelidae), *Planiliza abu* (Mugilidae), *Eidinemacheilus proudlovei, Oxynoemacheilus gyndes, O. hanae, O. kurdistanicus, O. zarzianus* and *Turcinoemacheilus kosswigi* (Nemacheilidae), *Silurus triostegus* (Siluridae), and *Glyptothorax kurdistanicus* (Sisoridae). While, five exotic species (14.2%) were listed in two families including: *Carassius auratus, Cyprinus carpio, Hemiculter leucisculus* and *Hypophthalmichthys molitrix* (Family Cyprinidae), and *Heteropneustes fossilis* (Heteropneustidae). The native distribution of *Carassius auratus* is in northern Asia and China. *Cyprinus carpio* naturally found in Europe and Asia, In Iraq they were first introduced from Holland and Indonesia. *Hemiculter leucisculus* was originally described from Peking, China. The native range of this species is from Maritime Russia south through China to Korea and Viet Nam. *Hypophthalmichthys molitrix* was originally described from China and the natural distribution is from the Amur River in the former U.S.S.R. southward to southern China. Also, *Heteropneustes fossilis* was described from Tranquebar, Tamil Nadu, India. These fishes were introduced into Iraqi water bodies for different purposes such as food fish, phytoplankton control, and as a biological control of mosquito and snail in order to control the parasitic diseases especially malaria and bilharzia (Coad, 2010).

**Table (2):** Scientific names of fishes collected from different water bodies in Sulaimani province with their numbers and status.

| Family and Scientific Names | Number | Status |
|---|---|---|
| **Family: Cyprinidae Rafinesque, 1815** | 20 | LC |
| *Acanthobrama marmid* **Heckel, 1843** | | |
| *Alburnus caeruleus* **Heckel, 1843** | 7 | LC |
| *Alburnus mossulensis* **Heckel, 1843** | 62 | NE |
| *Arabibarbus grypus* **(Heckel, 1843)** | 123 | VU |
| *Barbus lacerta* **Heckel, 1843** | 7 | LC |
| *Capoeta trutta* **(Heckel, 1843)** | 222 | LC |
| *Capoeta umbla* **(Heckel, 1843)** | 161 | LC |
| *Carasobarbus kosswigi* **(Ladiges, 1960)** | 5 | VU |
| *Carasobarbus luteus* **(Heckel, 1843)** | 89 | LC |
| *Carassius auratus* **(Linnaeus, 1758)*** | 54 | LC |
| *Chondrostoma regium* **(Heckel, 1843)** | 52 | LC |
| *Cyprinion kais* **Heckel, 1843** | 10 | LC |
| *Cyprinion macrostomum* **Heckel, 1843** | 322 | LC |

| | | |
|---|---|---|
| *Cyprinus carpio* **Linnaeus, 1758*** | 195 | VU |
| *Garra rufa* **(Heckel, 1843)** | 57 | LC |
| *Hemiculter leucisculus* **(Basilewsky, 1855)*** | 121 | LC |
| *Hypophthalmichthys molitrix* **(Valenciennes, 1844)*** | 2 | NT |
| *Leuciscus vorax* **(Heckel, 1843)** | 1 | LC |
| *Luciobarbus barbulus* **(Heckel, 1849)** | 108 | NE |
| *Luciobarbus esocinus* **Heckel, 1843** | 52 | VU |
| *Luciobarbus xanthopterus* **Heckel, 1843** | 31 | VU |
| *Squalius cephalus* **(Linnaeus, 1758)** | 37 | LC |
| *Squalius Lepidus* **Heckel, 1843** | 62 | LC |
| **Family: Bagridae Bleeker, 1858** | | |
| *Mystus pelusius* **(Solander, 1794)** | 8 | LC |
| **Family: Heteropneustidae Hora, 1936a** | 8 | LC |
| *Heteropneustes fossilis* **(Bloch, 1794)*** | | |
| **Family: Mastacembelidae Swainson, 1839** | 94 | LC |
| *Mastacembelus mastacembelus* **(Banks & Solander, 1794)** | | |
| **Family: Mugilidae Cuvier, 1829** | | |
| *Planiliza abu* **(Heckel, 1843)** | 76 | LC |
| **Family: Nemacheilidae Regan, 1911** | 40 | NE |
| *Eidinemacheilus proudlovei* **Freyhof, Abdullah, Ararat, Hamad & Geiger, 2016** | | |
| *Oxynoemacheilus gyndes* **Freyhof & Abdullah, 2017** | 14 | NE |
| *Oxynoemacheilus hanae* **Freyhof & Abdullah, 2017** | 5 | NE |
| *Oxynoemacheilus kurdistanicus* **Kamangar, Prokofiev, Ghaderi & Nalbant, 2014** | 12 | NE |
| *Oxynoemacheilus zarzianus* **Freyhof & Geiger, 2017** | 2 | NE |
| *Turcinoemacheilus kosswigi* **Bănărescu & Nalbant, 1964** | 2 | LC |
| **Family: Siluridae Cuvier, 1816** | | |
| *Silurus triostegus* **Heckel, 1843** | 20 | LC |
| **Family: Sisoridae Bleeker, 1858** | | |
| *Glyptothorax kurdistanicus* **(Berg, 1931)** | 19 | DD |
| **Total** | **2100** | **-** |

***=** Exotic fish, **DD=** Data Deficient, **LC**= Least Concern, **NE=** Not Evaluated, **NT=**Near Threatened, **VU= Vulnerable**

The most abundant and wide spread species recorded in this investigation were *known C. macrostomum* with ratio 15.3%, followed by *Capoeta trutta* with the ratio of 10.5%, then *Cyprinus carpio* as a third rank with the ration 9.2%. It was clarified that *Leuciscus vorax* was scarce with the ratio 0.04%. According to International Union for Conservation of Nature (IUCN) red list of threatened species, four of the native species are vulnerable including *Arabibarbus grypus, Carasobarbus kosswigi, Luciobarbus esocinus* and *Luciobarbus xanthopterus* (Table 2). Apparently, many factors may affect decreasing these fish species in Sulaimani Providence water bodies such as illegal way of fishing, overfishing, fishing in a spawning season, climate change, flood, water pollutions, instruction of gravel mining on streams and rivers, and introducing the exotic species annually especially common carp which they compete the native species for the place and food. Moreover, demanding of local people on these types of fishes is another reason for more fishing by fisherman. The authors expect that the ichthyofauna of Sulaimani Province could be more than this investigation and need more ichthyologists to find them.

In the past years there were a few works on ichthyofauna in Sulaimani Province; Ciepielewski *et al.* (2001) mentioned the name of 20 species (*Barbus grypus*, *B. barbulus*,, *B. esocinus*, *B. kersin*, *B. longiceps*, *B. luteus*, *B. pectoralis*, *B. rajanonim*, *B. xanthopterus*, *Chondrostoma nasus*, *C. regium*, *Cyprinus carpio*, *Leuciscus cephalus*, *Mastacembelus mastacembelus*, *Silurus glanis*, *S. triostegus*, *Varicorhinus barroisi*, *V. damascinus*, *V. trutta*, *V. umbla*) during their investigation in both Dokan and Derbandikhan Lakes. Abdullah (2006) recorded 23 species (*Acanthobrama marmid, Alburmus mossulensis, A. sellal, Barbus barbulus, B. belayewi, B. esocinus, B. grypus, B. kersin, B. luteus, B. subquincunciatus, B. xanthopterus, Capoeta trutta, Chondrostoma regium, Cyprinion macrostomum, Cyprinus carpio, Garra rufa, Leuciscus cephalus, L. lepidus, Varicorhinus trutta, Glyptothorax kurdistanicus, Heteropneustes fossilis,*

*Liza abu, Mastacembelus mastacembelus.*) from Dokan Lake. Abdullah *et al*. (2007) recorded 26 species (*Acanthobrama marmid, Aspius vorax, Barbus barbulus, B. esocinus, B. grypus, B. kersin, B. lacerta, B. luteus, B. xanthopterus, Capoeta damascinus, C. trutta, Chondrostoma regium, Cyprinion macrostomum, Cyprinus carpio, Garra rufa, Hypophthalmicthyes molitrix, Leuciscus cephalus, L. lepidus, L. spurious, Varicorhinus barroisi, V. umbla, Silurus glanis, Glyptothorax kurdistanicus, Heteropneustes fossilis, Liza abu, Mastacembelus mastacembelus*) in Derbandikhan Lake. Rasheed (2011) recorded five species (*Barbus grypus, B. esocinus, Capoeta damascinus, Carassius auratus, Cyprinus carpio*), Abdullah and Abdullah (2018) recorded 17 species (*Arabibarbus grypus, Barbus barbulus, Capoeta trutta, C. umbla, Carasobarbus luteus, Carassius auratus, Chondrostoma regium, Cyprinion macrostomum, Cyprinus carpio, Garra rufa, Hemiculter leucisculus, Hypophthalmichthys molitrix, Luciobarbus esocinus, Squalius lepidus, Mystus pelusius, Silurus triostegus,* and *Mastacembelus mastacembelus*) in the same Lake.

It seems from the previous study that mentioned above the biodiversity of fish species in Sulaimani Province which recorded by researchers was very limited and nearly all of them were recorded the same species and they were not recording a new species, this is due to the way of specimen collection, nearly all researchers depended on the fisherman whom they use gillnetting or hock for fishing, and they couldn't collect and record those fishes which they never reach to enough size in order to capture by gillnet. Moreover the place of fishing is another reason, most of researcher only collected the fish from the lakes and the large rivers, but they didn't collect fishes from small streams and springs. The evidence supporting this idea is the size of those fishes which they recorded by the researchers, most of them were fishes which they use as a food by local people and they present in the local markets.

## Recommendations

Gravel mining, garbage dumping, oil dumping, wastewater pipeline to river, sewage pollution, introduction of exotic aquatic species, illegal and over fishing are the main threats to fish diversity in Kurdistan Region of Iraq. So, it is suggested avoiding gravel mining on the rivers, treat all waste before discarding, and prevent over and illegal fishing. Also, Identify and manage a geographical area, recognized and managed, through legal or other effective means, as a protected area to achieve long-term conservation of all fish species, particularly threatened species. Moreover, Confirmative diagnosis (molecular study) is necessary for some fish species which closely similar to each other.

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