

THE CURRENT STATUS OF INDIGENOUS FRESHWATER FISHES IN JORDAN

Sayeeda Mir* and Nasht Hamidan¹

Department of Biological Sciences, Yarmouk University, Irbid, Jordan

Abstract: Considerable changes were revealed in the indigenous freshwater fish fauna during a field survey of six years from 2006 to 2008. Most of them are endangered and one endemic species, *Aphanius sirhani*, is under the threat of extinction. Four other species, *Garra rufa*, *G. ghorensis*, *Nemacheilus insignis* and *Aphanius dispar richardsoni* are also endangered. Misuse of the limited water resources, intensification of agriculture, overexploitation of fishing and the introduction of exotic species are considered to be major threats to Jordan's freshwater fish fauna.

Key words: Indigenous fishes, status, threats, conservation.

INTRODUCTION

Jordan is considered to be one of the most threatened countries in the world from the view point of its water resources. Most of the southeastern part of the country is desert and its aquatic fauna is restricted to rivers and a few water bodies distributed in the northwest. A detailed account of the fishes of Western Palestine was first given by Tristram (1884). Nelson (1973) mentioned some of the freshwater species: *Tilapia zillii*, *T. aureus*, *Barbus canis*, *Clarias lazera* and *Aphanius dispar* from Azraq Oasis. A comprehensive taxonomical revision was given by Krupp and Schneider (1989) on the fishes of Jordan River Basin and Azraq Oasis, followed by Mir (1990) on taxonomical and the geographical distribution of the freshwater fishes of Jordan and later by Hamidan (2004). The conservation of aquatic biodiversity in Jordan has not been given priority mainly due to the lack of scientific data and lack of knowledge in the implementation of conservation plans. However, globally various systems of categorization have been developed as for example the World Conservation Union (ICUN) which is not only a register of names of threatened species, but also a complete information on the threats and their conservation actions that can reduce the danger of extinction. Since the first studies done in the region by Krupp and Schneider (1989) significant changes in the distribution and abundance of several indigenous species of freshwater fishes have been observed. The numbers of water bodies have diminished and quality of water is affected with a parallel decline in the freshwater species of fish.

*Corresponding author: E-mail sayeeda_mir@yahoo.com ¹Royal Society for the Conservation of Nature. Amman, Jordan.

An intensive survey was carried out first, to update the present status and changes in distributional pattern as a result of human activity, and secondly to propose suggestions, for necessary measures, to be taken into consideration in order to protect the indigenous freshwater fishes in Jordan.

MATERIAL AND METHODS

The studies are based on information gathered during a survey conducted from 2002 to 2008 in twenty three water bodies (Fig. 1) which included the rivers- River Yarmouk⁽¹⁾, River Jordan⁽²⁾, River Zarka⁽³⁾ and their tributaries; Dams- King Talal dam⁽⁴⁾ and Ziglab dam⁽⁵⁾; Streams and springs- Ain-El Qunaiya⁽⁶⁾, Birkt-El-Araays⁽⁷⁾, Ain Tais⁽⁸⁾, Tabaqt al Fahal⁽⁹⁾, Dair- Alla⁽¹⁰⁾, Wadi Kufranja⁽¹¹⁾ and Wadi Sir⁽¹²⁾ (north of Jordan); Springs around the Dead Sea- Mujib⁽¹³⁾ and Hydan⁽¹⁴⁾, Ain Al-Haditha⁽¹⁵⁾, Wadi Al Hassa⁽¹⁶⁾, Wadi Fifa⁽¹⁷⁾ and Wadi Khneizerah⁽¹⁸⁾; Azraq Oasis⁽¹⁹⁾ (east of Jordan), Afra and Burrbaita⁽²⁰⁾, Karameh dam⁽²¹⁾, Ghour Fifa⁽²²⁾, Ghour El-Safi⁽²³⁾ (south of Jordan). Gill nets, seine nets and hand nets were used to collect fishes from shallow, especially narrow, streams (10 to 30 cm deep). Electrofishing gear (seven KW) was used mostly, between sunset and midnight, in deep and wide streams (up to one meter depth) and ponds, for about 60-80 minutes during each round. Azraq pools were sampled once a year under the Azraq Killifish monitoring program. The fishes were released after identification and data were recorded for study purposes. Information from the local fishermen, conversations with the people involved in fish culture and studies conducted by other investigators were taken into consideration.

RESULTS

The indigenous freshwater fish fauna of Jordan is largely riverine, represented by five families *viz.* Cyprinidae, Cyprinodontidae, Clariidae, Balitoridae and Cichlidae, including fourteen species. Table 1 summarizes the present status and their zoogeographical affinities of indigenous freshwater fishes in Jordan. Cyprinidae is the largest, widely distributed fish family. Three major cyprinids, *viz.* *Barbus canis*, *B. longiceps* and *Capoeta damascina* have been reported from the running waters of streams and rivers to the polluted waters of King Talal dam. *B. canis* was also recorded from Azraq Oasis during the 1980s where it is reported to have been introduced although the origin of its introduction remains unknown. The three species have also been collected from an isolated pool in Ain- El-Qunaiya (east of Jerash). They also inhabit the springs in Mujib, Hydan, Hassa, and Khaneizerah in the south of Jordan. The Dead Sea basin is the southern most edge of distributional range for *Capoeta*

damascina. Being commercially important, huge numbers of these fishes are seen in the local fish markets. *Acanthobrama lissneri* was reported from River Jordan, River Yarmouk and Azraq Oasis. The species is endemic and was accidentally introduced in Azraq when *Tilapia zillii* was being introduced. *Garra ghorensis* and *G. rufa* are the other two species of cyprinids present in Jordan.

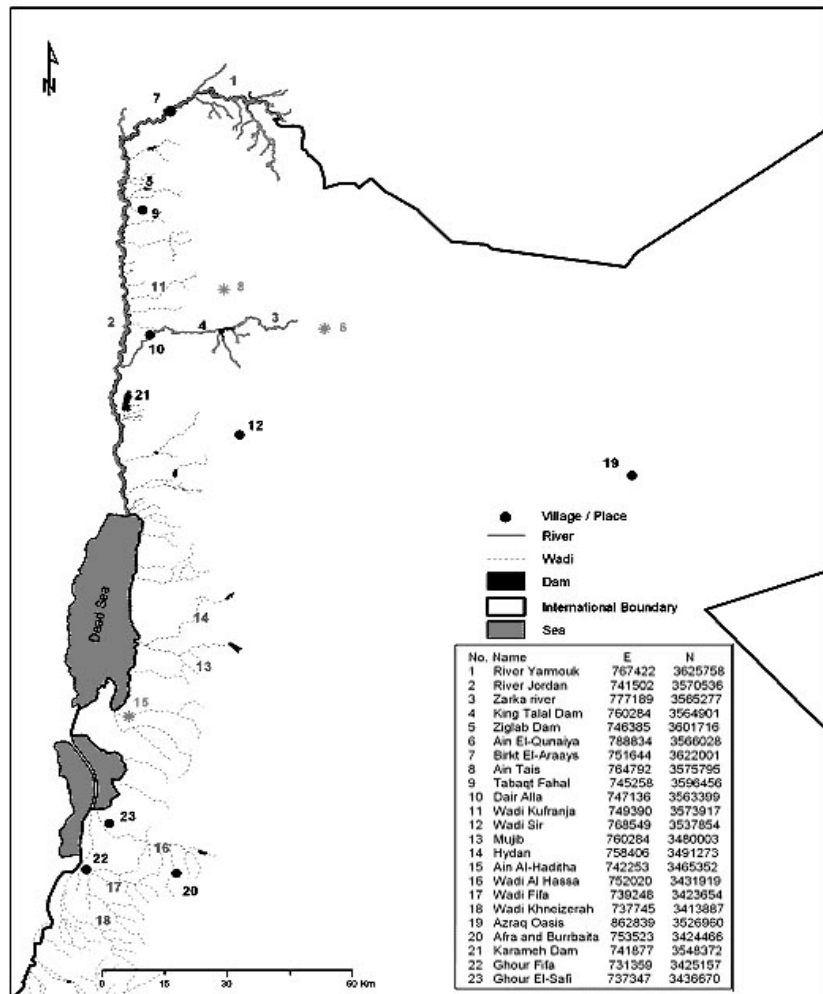


Fig. 1. Showing collection sites.

G. ghorensis is an endemic fish, inhabiting warmer waters around the Dead Sea area, starting from Ain Al Haditha to Wadi Khaneizerah and is also reported from some hot springs of Afra and Burrbaita (south of Jordan). *G. rufa*, on the other hand, is found in cooler waters of the tributaries of Jordan and Yarmouk Rivers and in small inland pools and streams like Birkt-El-Araays and Ain Tais (north of Jordan). Recent studies have revealed an interesting distributional

phenomenon where the species *G. rufa* extends to the Dead Sea basin reaching Mujib River where it is replaced by *G. ghorensis* in the area of Ain Al Haditha, 17 Km to the south of Mujib River. During the survey of Tabaqt al Fahal an isolated population of this species was found and few (4-6) specimens were collected from the spring. *Hemigrammocapoeta nana* is one of the uncommon cyprinids with no commercial value because of their small size. Being indigenous to Jordan its distribution is restricted only to the small tributaries of the Jordan and Yarmouk rivers and in Ain-El-Qunaiya. *Nemacheilus insignis*, a Balitorid, is restricted to small and shallow streams with stony bottoms. This species inhabits the tributaries of Jordan and Yarmouk Rivers and has also been collected along some streams within the Mediterranean zone that drain into the Jordan valley, Wadi Sir, Ain-El-Qunaiya and Wadi Kufranja to the north. Towards the south its range of distribution is the Mujib River. Being a small sized fish, it is unknown to people in general, but known to local fishermen as "Zibal" (means cleaner) because of its feeding habits.

Table 1. Present status and zoogeographical affinities of indigenous freshwater fishes in Jordan.

Species	Zoogeographical affinities	Present Status	Commercial value
Fam: Cyrinidae			
<i>B. canis</i>	Palaearctic	vulnerable	commercial
<i>B. longiceps</i>	Palaearctic	gradually decline vulnerable	commercial
<i>lissneri</i>	Palaearctic	common	commercial
<i>damascina</i>	Palaearctic	less common/vulnerable	commercial
<i>H. nana</i>	Indoasiatic	not defined	none
<i>G. ghorensis</i>	Afrotropical	nationally endangered	none
<i>G. rufa</i>	Indoasiatic	nationally endangered	none
Fam: Balitorida			
<i>N. insignis</i>	Palaearctic	endangered	none
Fam: Clariidae.			
<i>A. gariepinus</i>	Afrotropical	common	commercial
Fam: Cichlidae.			
<i>O. aureus</i>	Afrotropical	common	commercial
<i>S. galilaeus</i>	Afrotropical	insufficient data	commercial
<i>T. zillii</i>	Afrotropical	common	commercial
Fam: Cyprinodontidae			
<i>A.d. richardsoni</i>	Tethyes relict	nationally endangered	none
<i>A. sirhani</i>	Tethyes relict	restricted & critically endangered	none

The distribution of *Clarias gariepinus* seems to be limited to River Jordan only. The fish was reported from Azraq Oasis, where it has been recently introduced from unknown sources. Small populations were reported to be raised

in private fish farms in the Azraq area. Though the fish grow big in size, 500 and 800 mm in Jordan, specimens ranging between 300 – 500 mm were also observed during the survey. In the local fish market, the fish is known as “balbooth”. Bigger specimens have been reported in the King Talal Dam by local fishermen.

Family Cichlidae is the second largest commercially important and widely distributed in Jordan. Three species viz. *Sarotherodon galilaeus*, *Oreochromis aureus*, and *Tilapia zilli* were collected from the River Jordan, its tributaries and also from Azraq Oasis. During the present field studies one of the species, *S. galilaeus*, was not recorded from the Azraq Oasis. Commonly known as 'Samak Tillopi/or Al-Misht', the cichlids are favorites among people and private fish farmers who raise them for commercial purposes.

Family Cyprinodontidae includes small sized fishes of no economic value. Small populations of *Aphanius dispar richardsoni* are highly restricted to wadis and shallow freshwater streams around the Dead Sea basin. Being euryhaline, this fish can tolerate high salinity waters (2000 ppm) as in Ghour Fifa which is the southern end of Dead Sea. It has also been found to inhabit the westernmost reaches of streams that extend westwards to the Dead Sea basin. *Aphanius sirhani* is another cyprinodont which is endemic to Jordan and is present only in Azraq Oasis. The fish used to inhabit a separate northern pool of the Oasis, Ain Asad, which is 14 km to the south of Azraq.

DISCUSSION

Jordan represents a land bridge between the three major zoogeographical continents: Africa, Asia and Europe. Freshwater fishes, mostly riverine, are not only the imperiled groups of species in Jordan, but also one of the interesting groups because of their mixed origin. Although their number is small the endemism within this small group of fishes is clearly observed from their zoogeographical affinities. Out of the fourteen indigenous species five are Palearctic (*Barbus canis*, *B. longiceps*, *Capoeta damascina*, *Acanthobramma lissneri* and *Nemachelius insignis*), five are Afrotropical (*Garra ghorensis*, *Clarias gariepinus*, *Oreochromis aureus*, *Tilapia zillii* and *Sarotherodon galilaeus*), two Indoasiatic (*Garra rufa* and *Hemigrammocapoeta nana*) and two are relicts from the Tethys Sea (*Aphanius dispar richardsoni* and *A. sirhani*). During the present investigations substantial changes in the distribution and abundance of the fish species were observed to have been taken place since 1989. Many of the fishes have either been extirpated from their natural habitats or are under threat of extinction due to number of changes. These changes have mostly been introduced, directly or indirectly, by human beings without knowing the

awareness of the outcome of such changes. Changes like these are clearly observed in Tabaqt-Fahal, in Ain- El-Qunaiya and in Ghour El-Safi. In Tabaqt-Fahal an isolated population of *G. rufa* used to inhabit a spring quite near the Roman ruins, but as a result of excavation with heavy vehicles constantly going to or from the site- not only the spring, but also streamlets flowing down the spring, have been altered. Altered flow regimes are having increasingly adverse effects on indigenous fish habitats. Ain-El-Qunaiya lies at the head of river Zarka. Its surface water however is isolated from the river. Small springs pour into a basin of about 10 m diameter and one m deep. The water is clear with gentle flow. Four species (*viz. B. canis, C. damascina, G. rufa* and *N. insignis*, and hybrids of *B. canis* and *C. damascina*), previously collected and reported by Mir *et al.* (1988) have been extirpated by road constructions from that area. Concrete water reservoir was built nearby wherein, an exotic species, *Poecilia reticulata* was noticed. Another disastrous location for the survival of indigenous fish species is River Zarka, considered to be the third largest river in Jordan. Once a freshwater river, it used to have a variety of aquatic fauna, but is now considered to be the most polluted rivers in the country with the high levels of Cd, Pb and Al in addition to a deluge of industrial waste which is continuously pouring in (Awad 1997) and making the river more and more polluted. The last reports of fishes like *A. lissneri* and *N. leontinae* which were used to inhabit the river are that of Krupp and Schneider (1989), and Krupp (1987), respectively. The spring at Deir Ain Abata is located at the base of the slope immediately northwest of an ancient site in the region of Ghour-El-Safi, was inhabited by an interesting biological community. During the collection trip along with the German researcher, Dr. Politis in 1986, the first author recorded and collected *A. d. richardsoni* and *G. ghorensis* with three species of mollusks: *Melanoid tuberculata*, *Melanopsis costata*, and *Theodoxus jordani*. During the field survey it was observed that the entire topography has changed because of road building and dumping of the soil in and around the spring during excavation. Politis (1988) reported that not the spring was used by a cement-block maker, but also the area was being developed by the Jordanian Valley Authority, which had built an irrigation canal to catch the water flow. The dumping of soil in and around the spring has extirpated a land locked population of *G. ghorensis* and *A. d. richardsoni*. However, small population of *A. d. richardsoni* was observed in the nearby shallow streamlets and few specimens (5-8) were collected. It must be noted that *G. ghorensis*, was not observed in these streamlets. The species is reported nearly extinct in Israel. The rate of population decline is about 10% for the last ten years due to the introduction of *Gambusia affinis* (Crivelli 2006). In Jordan this small land locked population of fish is endangered not because their ecological niches are vulnerable with great threat of evaporation due to high

temperatures (20-45°C) in the region, but also due to the changing habitat, as described above. Another possible threat for *G. ghorensis* population in Ghour-El-Safi is the introduction of exotic species, such as *O. aureus*, a low priced fish, into the water bodies inhabited by *G. ghorensis*. The high breeding potential of *O. aureus* (Trewavas 1983) may be a contributory factor to the population decline of *Garra*, along with other considerations, such as the aggressive and predatory behavior of *O. aureus*. Azraq Oasis is one of the most striking examples where environmental changes and the impact of exotic species on the indigenous fish fauna may be well and clearly observed. Jordan's Azraq depression lies between Syria and Saudi Arabia. Winter rains bring 25 million cubic meters of water annually in the catchments basin. However, cities like Amman siphon it is all off. Jordanian farmers take another 25 million from Azraq's ground water. With humans consuming twice that nature provides, the once-lush Oasis has become parched, and is being enveloped by the surrounding desert resulting in the death of animals. Grazing land has dried up and farmers have lost their means of income and there has been a complete collapse of the whole eco-system in the area. The wetland used to be a location of rich biodiversity of migratory birds, providing a natural habitat for numerous aquatic and terrestrial species, including the Azraq Killifish *Aphanius sirhani*. As previously reported (Krupp and Schneider 1989, Mir 1990), the Oasis was inhabited by three cichlids (*T. zilli*, *O. aureus* and *S. galilaeus*), three cyprinids (*A. lissneri*, *B. canis* and *B. longiceps*) and one Clariidae (*C. gariepinus*). During 1990 and 1994, Azraq Oasis was completely dried up impacting negatively on migratory birds and other animal fauna. Only two cichlids (*T. zilli* and *O. aureus*) and two cyprinids (*A. lissneri* and *B. canis*) in addition to *A. sirhani*, have survived in the Azraq pools. The last record of *C. gariepinus* from the Oasis is that of Weissenbacher and Horst (2000), the fish used to inhabit Sauda pool that was totally dried up in 2000. The last record of *S. galilaeus* from Azraq Oasis is from Mir (1990). The impact of the fishes on the endemic fish population of *A. sirhani* has been intensively studied by the second author during the field survey. Medium sized cichlids utilize shore lines as their territory and feed on the eggs and fries of *A. sirhani*, which has very limited breeding grounds (breeds near the shore lines) and water level in pools fluctuate daily causing dryness in the breeding ground of the fishes. Another threat is that the feeding habits of *A. lissneri* were found to be similar to that of *A. sirhani*. Once reported as extinct (Mir 1985) it has been reintroduced into the waters of the Oasis by the efforts of the Royal Society for the Conservation of Nature (RSCN) in the year 2000. The species have however been maintained in the reserves, where they continue to thrive through captive breeding. It must be noted here that *A. sirhani* is no more found in wild and attempts have been

made to tentatively reintroduce into the wild, but they still face a very real threat of extinction (Weissenbacher and Horst 2000).

Concluding remarks: Present studies on the indigenous freshwater fish fauna of Jordan is in agreement with the report published by IUCN (Smith and Darwall 2006) that the indigenous freshwater fauna is under great threat. Series of impacts and process have contributed to the status of freshwater fish fauna. The current studies clearly reveal that the threat is a result of the misuse of limited water resources for human consumption and irrigation purposes. Changing ecological conditions, increasing human population, high level of industrializations in addition to overexploitation and introduction of exotic fishes for commercial purposes is another reason for endangerment. The result of the misuse of water in the Azraq Oasis extirpated *A. sirhani*, from the wild. There are different reasons for the endangerment of fauna, but most serious change is the loss of habitat. Development and urbanization in remote areas are a big threat to the freshwater ecosystems. In our opinion local authorities should take the maintenance and protection of these small and isolated ecosystems into consideration before building dams and roads so that both the fish and the habitats are protected. The Ain-El Qunaiya populations of two species of *Barbus* are believed to be extirpated from their natural habitat due to road construction. Attention also needs to be paid to small-sized, land-locked population of fishes like *Aphanius* sp., *Garra* sp. and *Nemacheilus* sp. which inhabit shallow and small streams and pools. Introduction of exotic species to the native waters is another major threat. Exotic species, like tilapias and carps, are commonly used in aquaculture by the farmers for commercial purposes in the inland waters. Though most of the ponds in which they are cultured are quite a distance away from the rivers, but some are not and there are chances of escaping fishes into the rivers or into neighboring water bodies, as *Poecilia reticulata* was observed nearby Ain-El-Qunaiya and some red tilapias were collected from Jordan River. Hybridization, competition for survival and feeding behaviors of such exotic species are the main threats to indigenous fauna because the reproductive behaviors and spawning habitats for most of the fishes are not known in details. Conservation plans and protection of native fish fauna should be given high priority by governmental, public and private sectors. Awareness among local people would enhance the policy of conservation.

Acknowledgements: The authors wish to thank Mrs. Veena Halady for going through the manuscript and giving useful suggestions. Thanks are also due to Yasmine Hajeer for preparing the maps. The authors are also grateful to the people who helped during the survey.

LITERATURE CITED

- AWAD, M. 1997. Environmental study of the Amman Zerqa Basin Jordan. *Envir. Geology* **33**: 54-60.
- EL-ABSY, A. and MIR, S. 1986. A new record of *Blennius fluviatilis* from Jordan. *Zool. Middle East* **1**: 114-116.
- HAMIDAN, N. 2004. The fresh water fish fauna of Jordan. *Denesia* **2**: 1-10.
- KRUPP, F. and SCHNEIDER, W. 1989. The fishes of the Jordan river drainage basin and the Azraq Oasis. *Fauna of Saudi Arabia* **10**: 347-416.
- KRUPP, F. 1987. Freshwater Ichthyogeography of the Levant. In: F. Krupp, W. Schneider & Kinzelbach (eds): *Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East*. Beihefte zum Tubinger Atlas Des Vorderen Orients **28**: 229- 237.
- MIR, S. 1985. Danger of extinction of *Aphanius sirhani* from Azraq oasis. *The Jerusalem Star*. **4**: 3.
- MIR, S. 1990. Taxonomical and the geographical distribution of the fresh water fishes of Jordan. *Bangladesh J. Zool.* **18**: 157-175.
- MIR, S., AL-ABSY and KRUPP, F. 1988. A new natural intergeneric cyprinid hybrid from the Jordan River drainage with a key to the large barbine cyprinids of the southern Levant. *J. Fish. Biol.* **32**: 931-936.
- NELSON, J.B. 1973. *Azraq Desert Oasis*. Cox & Wyman Ltd, London. pp. 1-436.
- POLITIS, K.D. 1988. Excavations at DEIR AIN" ABATA. *Annal of the Department of Antiquities of Jordan* **33**: 227-233.
- SMITH, K.G. and DARWALL, W.R.T. 2006. *The Status and Distribution of Freshwater Fish Endemic to the Mediterranean Basin*. IUCN Red List of Threatened Species-Mediterranean Regional Assessment. IUCN, Gland, Switzerland and Cambridge.
- STEINITZ, H. 1951. On the distribution and evolution of the cyprinodont fishes of the Mediterranean region and the Near East. *Bonne Zoologisch Beitrage* **2**: 113-124.
- TREWAVAS, E. 1983. *Tilapine fishes of the genera Sarotherodon, Oreochromis, and Danakilia*. British Museum (Natural History), London, 583 pp.
- TRISTRAM, H.B. 1884. The Survey of Western Palestine: *The Fauna and Flora of Palestine*. **XXII** + 455 pp. London.
- WEISENBACHER, A. and HORST, Z. 2000. *Report on the current situation of Aphanius sirhani*, University of Vienna, Vienna, Austria, 33 pp.
- CRIVELLI, A.J. 2006. *Garra ghorensis*. In: IUCN 2010. IUCN Red List of Threatened Species.

(Manuscript received on October 26, 2011; revised on January 6, 2012)