

SURVEY AND ICHTHYOFAUNA OF GREAT ZAB RIVER IN DERALOK HYDROPOWER PLANT

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ABSTRACT

The objective of the study is to upgrade the knowledge of fish compartments in the special sector of Great Zab river where has to be construct the Weir for Deralok Hydropower Plant; in way of collected all information related to the actual life of fish and to find out the fishes that are naturally found in Deralok during the period from December 2013 to February 2015 in the sector to be affected by the weir for adding extra information about fishes' habits and immigration of fishes. A total of 82 freshwater fishes from Deralok during the survey period, belong to 11 species, namely: *Garra rufa* (Heckel 1843) Doctor Fish, *Chondrostoma regium* (Heckel,1843); Baloot muluki, *Luciobarbus xanthopterus* (Heckel,1843); Gattan, *Barbus belayewi* (Menon,1960); Toueni, Birtein, *Barbus barbulus* (Heckel,1846); Abu Baratun, *Cypinion kais* (Heckel,1846); Buunii Saghir, *Capoeta trutta* (Heckel,1843); Touyeni, *Barbus grypus* (Heckel,1843); Shabout, *Mastacembelus mastacembelus* (Banks and Solander in Russell,1794); (Marmaritch); *Crucian carp* (*Carassius carassius*); (Shokhatt), and *Liza abu*: (Beyah).

KEYWORDS: Fish population, Great Zab River, Deralok Hydropower plant, Dêrelûk
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INTRODUCTION

Deralok Hydropower Project is a runoff river plant and it is expected to generate between 30 and 40 Mega Watt to for the Kurdistan Region Electric System located in the Deralok sub-district, Amadya District of Duhok Governorate. The weir presents problems for both upstream and downstream fish migrations; the impact on fish migration depends mostly on the swimming ability and behavior of migrating fishes. For this reason a fish pass has been included in the design so as to recover the stream connectivity. Kurdistan is very rich in freshwater bodies, including many lakes, rivers, streams and springs, such as Dokan Lake, Darbandikhan Lake, Dohuk Lake, Bawaswar Lake, the Great Zab River, the Small Zab River and the Sirwan River. These water bodies are good for many aquatic organisms, usually Ichthyofauna. Unfortunately, the study of these fauna on aquatic bodies was very limited (Abdullah *et al.*, 2007).

Biodiversity affected by challenges and threats distinguished in two categories indirect

and direct drivers of change. Some factors, such as overpopulation, technology, and lifestyle, can directly affect ecosystems, such as fishing with fertilizers to increase production. These ecosystem changes can also change the services provided by ecosystems, which can adversely affect human health and well-being. Many of the threats and challenges mentioned above are not limited to a single region or local area, but affect in varying degrees all of Iraq. These include legal fishing and hunting practices. The Great Zab River, which originates in the mountains of the Kurdistan chain at an altitude of 3,000 meters above sea level. The river receives most of its water flowing along the left margin from the contribution of four large tributaries (Hassan, 2010 ; Shekha, 2016). Many factors that are vital in determining the extent to which fish species are limited to a particular area are: (i) the choice of certain types of environmental conditions in the region, (ii) (iii) none or fewer competitors & (iv) pollution. Ten of the species under threat seem to be confined to the two major tributaries of the Tigris, the Big and the Small Zab rivers, but only two species, *Barbus subquincunciatus* and *Barbus rajanorum*, have taken refuge in the

artificial dam lakes of Dokan and Derbandikhan. Other types of threats rejected other branches of the Tigris River in eastern Iraq. The change in the distribution of these species began in the late 1950s and early 1960s, and has since become evident in the number of decomposition and fragmentation (Maza, 2005; Jawad, 2013).

Seasonal change in the number of zooplankton show that the optimal time for growth is from August to November, which may be due to the increase in the number of phytoplankton. The same phenomenon is described by Razzaque *et al.*, 1995; Ehshan *et al.*, 2000 and Ali, 2010). Ali (1989) was identified 11 species of fishes (*Barbusbarbulus*, *B. esocinus*, *B. lacerta*, *B. luteus*, *Cyprinionmacrostomum*, *Euglytosternumlineatum*, *Leuciscuscephalus*, *L. lepidus*, *L. spurius*, *Torgrypus* and *Varicorhinusumbla*) from Greater Zab River. *E. lineatum* and *L. spurius* recorded for the first time in Iraq. While Abdullah (2002) was recorded 25 species belonging to seven families (Cyprinidae, Bargridae, Siluridae, Sisoridae, Heteropneustidae, Mugilidae and Mastacembelidae) from Greater Zab River at Aski-kalak and recorded 18 species belonging to four families (Cyprinidae, Siluridae, Mugilidae and Mastacembelidae) from Lesser Zab River at Alton kupri, 16 fish species were sympatric in both rivers.

The aim of the study is to increase the knowledge of the fish sector in the private sector of the Great Zab river Weir for the Deralok Hydroelectric Power Plant; A way to gather all information about the real life of fish for one (1) year in the industry to add extra information about fish habits and fish migration. Therefore, the main purpose was to add columns to the fish datasheet for comments and provide additional explanations about the habits of the fish. This fish survey conducted in the Deralok River will be carried out by collecting random numbers, fish species and age in each season and by examining the fish. Check each season alone (winter, spring, summer and full), select three collection area stations, compare the Deralok river (upstream, middle and downstream), and compare the distribution of fish from each station, assigning different seasons and observing the biodiversity of the fish data include station area, type of fish (common and scientific name), fish length, fish weight,

maturity (juvenile and adult), gender (male or female) and feeding habits (herbivore, omnivore or carnivore).

MATERIAL AND METHODS

Fish Collection: The fishing extended from the early morning to the afternoon to recording all information for each species. The collecting site into three sites: Upstream site - latitude (37.07425), longitude (43.65876); Midstream site - latitude (37.07264), longitude (43.65858); downstream site - latitude (37.07229), longitude (43.65484) as shown in Figure (1):

Fish survey in Deralok River made as the following:

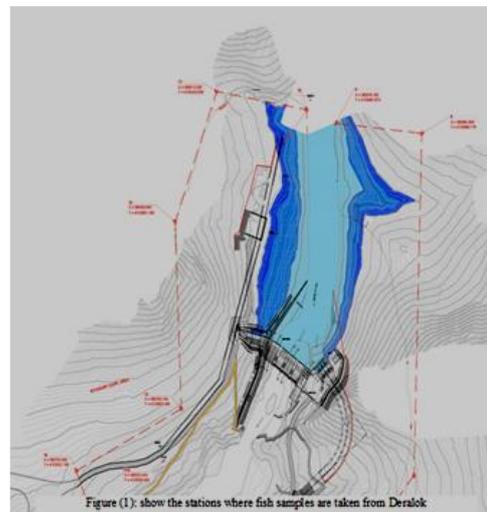


Fig. (1): show the stations Fish sample are taken from Deralok.

- 1- Surveying the fish by collecting random number, types & ages of fish each season.
- 2- Check a repeat on each season alone (winter, spring, summer, & full).
- 3- Choosing three collecting areas stations from Deralok river (upstream, midstream and downstream) & comparing the distribution of fish from each station.
- 4- Observing the biodiversity of fishes through different seasons.
- 5- All the collecting data will depend on fish data sheet which include the following parameters:
Station area, fish type (common & scientific name), fish length, fish weight, maturity (fingerling - juvenile & adult), Sex, feeding habits (herbivore, omnivore or carnivore).

Table (1): show the Length, width, sex, maturity & feeding habits of Fish at 1st collection site (Upstream).

Fish Type			Individual Fish Data					
No.	English Name	Scientific Name	Length (cm)	Weight (gm)	Sex	Maturity	Feeding Habits	Economic Importance
1.	Marmaritch	<i>M. mastacembelus</i>	22	180	M	J	H	Ne
2.	Shabout	<i>Barbus grybus</i>	15	160	M	J	O	E
3.	Beyah	<i>Liza abu</i>	11	110	F	J	C	Ed
4.	Shokhatt	<i>Carassius carassius</i>	12	150	M	J	C	Me
5.	Touyeni	<i>Barbus belayewi</i>	24	250	F	J	O	Me

M=Male, F=Female, F=Fingerling, J=Juvenile, A=Adult, H=Herbivore, C=Carnivore, O=Omnivore, E=Economic, NE= Not Economic, ME= Middle Economic, ED= Economic for fish Diets.

This table show the presence of Marmaritch, Shabout, Beyah, Shokhatt, and Touyeni

Table (2): show the Length, width, sex, maturity & feeding habits of Fish at 2nd collection site (Midstream).

Fish Type			Individual Fish Data					
No	Common name	Scientific name	Length (cm)	Weight (gm)	Sex	Maturity	Feeding Habits	Economic importance
1.	Marmaritch	<i>M. mastacembelus</i>	18	150	F	J	H	Ne
2.	Shabout	<i>Barbus grybus</i>	16	130	M	J	O	E
3.	Baloot Muluki	<i>Chondrosto maregium</i>	10	80	M	J	H	E
4.	Touyeni	<i>Capoeta trutta</i>	24	250	F	J	O	Me
5.	Doctor Fish	<i>Garra rufa</i>	13	50	M	J	H	Me

M=Male, F=Female, F=Fingerling, J=Juvenile, A=Adult, H=Herbivore, C=Carnivore, O=Omnivore, E=Economic, NE= Not Economic, ME= Middle Economic.

While this table show the presence of Marmaritch, Shabout, Baloot Muluki, Touyeni and Doctor Fish.

Table (3): show the Length, width, sex, maturity & feeding habits of Fish at 3rd collection site (Downstream)

Fish Type			Individual Fish Data					
No	English Name	Scientific Name	Length (cm)	Weight (gm)	Sex	Maturity	Feeding Habits	Economic Importance
1.	Buuni Saghir	<i>Cypinion kais</i>	15.5	80	F	J	H	Ne
2.	Abu Baratum	<i>Barbus barbulus</i>	23	120	F	J	O	E
3.	Toueni, Birtein	<i>Barbus elayewi</i>	25	110	M	J	H	Ne
4.	Gattan	<i>Luciobarbus xanthopterus</i>	22	170	M	J	O	E
5.	Baloot Muluki	<i>Chondrostoma regium</i>	23	100	F	J	H	Ne
6.	Doctor Fish	<i>Garra rufa</i>	12.4	40	M	J	H	Me

M=Male, F=Female, F=Fingerling, J=Juvenile, A=Adult, H=Herbivore, C=Carnivore, O=Omnivore, E=Economic, NE= Not Economic, ME= Middle economic.

While this table show the presence of Buuni Saghir, Abu Baratum, Toueni, Birtein, Gattan, Baloot Muluki and Doctor Fish.

Table (4): show the Length, width, sex, maturity & feeding habits of Fish at All the collection sites.

Fish Type			Individual Fish Data							
No	English Name	Scientific Name	Site	Length (cm)	Weight (gm)	Sex	Maturity	Feeding Habits	No. of fish	Economic Importance
1.	Buuni saghir	<i>Cypinion kais</i>	U-M-D	18	90	M & F	J	H	5	Ne
2.	Abu baratum	<i>Barbus barbulus</i>	M-D	22	110	M & F	J	O	6	E
3.	Toueni, Birtein	<i>Barbus belayewi</i>	U-D	30	210	M & F	J	H	14	Ne
4.	Gattan	<i>Luciobarbus xanthopterus</i>	U-M	25	120	M & F	J	O	13	E
5.	Baloot muluki	<i>Chondrostoma regium</i>	U-M-D	22	80	M & F	J	O	13	Ne
6.	Doctor fish	<i>Garra rufa</i>	U-M-D	13	50	M & F	J	H	8	Me
7.	Touyeni	<i>Capoeta trutta</i>	U-D	24	250	M & F	J	O	8	Me
8.	Marmaritch	<i>M. mastacembelus</i>	M	18	150	F	J	H	3	Ne
9.	Shabout	<i>Barbus grybus</i>	U-M-D	16	130	M & F	J	O	9	E
10.	Beyah	<i>Liza abu</i>	U-M-D	11	110	F	J	C	2	Ed
11.	Shokhatt	<i>Carassius carassius</i>	M	12	150	M	J	C	1	Me
									Total:	
									82	

U=Upstream, M=Midstream, D=Downstream, M=Male, F=Female, F=Fingerling, J= Juvenile, A=Adult, H=Herbivore, C=Carnivore, O=Omnivore, E= Economic, NE= Not Economic, ME= Middle Economic, ED= Economic for fish Diets.

While this table show the presence of Buuni Saghir, Abu Baratum, Toueni, Birtein, Gattan, Baloot Muluki, Doctor Fish, Touyeni, Marmaritch, Shabout, Beyah and Shokhatt

RESULTS AND DISCUSSION

A total of (82) different specimens of fishes were collected from Deralok during the period from December 2013 to the end of February 2015, in the 1st collection seven samples namely; (2) Marmaritch, (1) Shabbout, (2) Beyah, (1) Shokhatt, and (1) Touyeni, in the 2nd collection with five samples namely; (3) Shabbout, and (2) Touyeni, in the 3rd collection four samples namely; (2) Shabbout, and (2) Touyeni while the 4th collection three samples were collected namely; (1) Shabbout, (1) Baloot muluki and (1) Touyeni, the 5th collection include four samples namely; (1) Shabout, (1) Baloot muluki, (1) Touyeni and (1) Marmaritch, the 6th collection collect only three samples namely; (1) Shabout, (1) Baloot muluki and (1) Touyeni, the 7th

collection six samples namely; (2) Gattan, (1) Baloot muluki, (1) Doctor fish and (2) Touyeni, Birtein.

The 8th collection collect just one sample namely; Touyeni, Birtein, in the 9th collection twenty four samples namely; (5) Gattan, (3) Baloot muluki, (3) Buuni Saghir, (4) Abu Baratum, (4) Doctor Fish and (5) Touyeni, Birtein, the 10th collection twelve samples were collected namely; (2) Gattan, (3) Baloot muluki, (2) Abu Baratum, (3) Doctor fish and (2) Touyeni, Birtein, in the 11th collection three sample found namely; (1) Touyeni, Birtein, (1) Baloot muluki and (1) Gattan.

The 12th collection collect one sample of Buuni Saghir, the 13th collection include seven samples namely; (3) Gattan, (1) Baloot muluki, (1) Buuni Saghir and (2) Touyeni, Birtein, finally the 14th collection two samples namely; (1) Baloot muluki and (1) Touyeni, Birtein were found.

The collected species of fish from Deralok during the survey period were the following:

1. *Garra rufa* (Heckel 1843): Doctor Fish

Local name at Deralok is Djulakemase. This fish has not any economic importance in Deralok. The Maximum total length was determined between 14cm to 23cm. Studies on the length-weight relationship for this species determined a value of $a=0.015$, and $b= 3.15$. Using these values in the formula $W=aL^b$, we gain a theoretical maximum weight of 61g. (Attains 24 cm total length). (Vazirzadeh *et al.*, 2014). Environmental conditions of the streams in which fish recorded were observed as follows: largely of coarse substrates, water depths typically ranged from 30 to 50 cm, pH ranged from 7.0-9.0, dissolved oxygen ranging from 2.9-14.8 mg·l⁻¹, temperatures usually ranging from 15-28°C, water velocities from 1.0 - 34.5 m³·s⁻¹, conductivity values ranging from 4.2-36.5 µS·cm⁻¹, and salinities ranging from 100-800 mg·L⁻¹. Additionally, *G. rufa* appear to be able to resist in environments contaminated by heavy metals. It appears to be able to resist the contaminated environments by heavy metals. This fish is known as doctor fish because of its role in cure of a dermatological disease, Psoriasis (Sayili *et al.*, 2007; Esmaeili *et al.*, 2005; Ararat *et al.*, 2008).

2. *Chondrostoma regium* (Heckel, 1843): Baloot muluki

Local name at Deralok is Zaryk. It is not an economic species; it reaches 40 cm and 1 kg. It is found in both rivers and lakes (and reservoirs). It was found in Iraq in large rivers such as Tigris, Little and Great Zabs and Diyala, as well as small rivers and streams and lakes such as Habbaniyah, Tharthar, Razhatha, and reservoirs such as Dukan and Derbandikhan. No reports of southern swamps. Total length and weight of *C. regium* ranged from 11.0 to 33.0 cm, 33.0 to 324.0 g, respectively. Female: male ratio was estimated as 1:0.903 and the age groups

of *C. regium* were 1-7. (Suicmez *et al.*, 2011; Serdar and Özcan, 2019).

3. *Luciobarbus xanthopterus* (Heckel, 1843): GATTAN

The local name in Deralok is Sumbelly. This is the third most important fish in the Basrah fish market. This type of fish is much sought after in the market and is used extensively in Dokan and Derbandikhan reservoirs as proof that there are no old fish in the hunt. The price of this species in Iraq before the war was US \$ 6 per kilogram, and in 2006 US \$ 13.50 per kilogram. The total length is 1.5 m and 8.6 kg from Shatt al-Arab River in Iraq. If stated correctly, while the maximum recorded weight was 30 kg. It is found in almost Iraqi local rivers such as Shatt Al-Arab River in Basrah governorate, southern Iraq, Dokan reservoir in Sulaimanya northern Iraq, Tigris near Kut city in the East and in Euphrates near Kerbala'a, it was reduced in some local marshes in the south. (Faddagh, 2016).

4. *Barbus belayewi* Menon, (1960): Toueni, Birtein

The local name at Deralok is Shelly. This species has no economic importance. Can reach 45 cm length, about 0.5 kg weight. Fed on detritus, algae and aquatic plants, it can be found tubercles on the head in spawning period in summer season; sex ratio (1:0.74). Found in Tigris, Euphrates, Great and Little Zabs, Rawanduz, smaller rivers and streams, lakes such as Razzazah, reservoirs such as the Dokan. No records for southern marshes. (Wahab, 2013).

5. *Barbus barbulus* (Heckel, 1847): *Luciobarbus barbulus* (Heckel, 1847): Abu Baratum

The local name at Deralok is Jinjin. Reaches 38 cm length. fed on detritus, large plants and benthic organisms including insects. Spawning is reported during the hot months between July and August from the Tigris River at Mosul. Found in the southern marshes, rivers such as the Tigris, Euphrates, Little Zab and Diyala, lakes such as Habbaniyah, and reservoirs such as Dukan. Maximum and minimum total lengths were 88cm and 21cm respectively. Maximum and minimum total weight was 8Kg and 100g respectively. *Luciobarbus barbulus* can be

distinguished from its close species, *L. pectoralis* by having thicker lower lip, stronger last unbranched dorsal fin ray and with stronger serration, longer barbels and posterior barbel passes the middle of the eye (vs. not reaching the middle of the eye in *L. pectoralis*), confirming the identity of both, as distinct species. (Mortezavizadeh *et al.*, 2010; Khaefi *et al.*, 2017).

6. *Cypinion kais* (Heckel, 1846): Buuni Saghir

The local name at Deralok is Shenek. None economic importance. Attains 21.5 cm total length. This species is recorded from marshes such as Al Kaba'ish (= Chabaish), large rivers such as the Shatt al Arab River, Tigris and Little Zab, smaller rivers such as the Khalis near Baghdad, in ponds such as those on Za'faraniyah Fish Farm south of Baghdad, in springs such as Chamal near Kirkuk, and in reservoirs such as the Dukan Dam. This type is found both in lentic and lotic environments. It is one of the dominant species of the Tigris fish community (FAO, 2014).

7. *Capoeta trutta* (Heckel, 1843): Touyeni

The local name at Deralok is kwesa. This fish is little used in Kurdistan because it is not highly valued for its taste, although a commercial fishery in the Dukan and Derbendikhan reservoirs occurred, as it was abundant. The largest fish were about 42 cm in total length and weighed over 600 g. Attains 52.7 cm. The age distribution of this population ranged from <1 to 6 years. Found in the Tigris river basin and generally live in the same environment. (Taghavi *et al.*, 2017; Çiçek *et al.*, 2017).

8. *Barbus grypus* (Heckel, 1843): Shabout

The local name at Deralok is Sormase. It is a very important fish. It was ranked third in the Iraqi aquatic bodies. The weight at the Basrah fish market was 3.5 kg. It forms about 50% of the commercial catch mass in the Dukan and Derbendikhan reservoirs in northeastern Iraq, is in heavy demand on local fish markets and is heavily exploited as evidenced by absence of older fish in catches. The fishing season for this species is April-October and January- July for lakes and marshes. Has very economic importance for people because of his good taste and have few spines. Can reach of 12 to 20 kg weight. High in some regions of Iraq; it is in need of conservation in some parts of its range. (Ararat *et al.*, 2008).

9. *Mastacembelus mastacembelus* (Banks and Solander in Russell, 1794): Marmaritch

The local name at Deralok is marmase. Mud worm or dwelling in mud worm. This type has not any economic importance for people because of his bad taste for local people. Can reach (58.4) cm length (Maximum length is less than 1m) and (1) kg weight. They are found in both stagnant and lotic waters and in fish farms and can get rid of drought by burying themselves in mud. This is very common in human-affected areas, such as polluted waters and lower areas near rivers and cities. It is more common than virgin waters. Usually found in streams and rivers with sand, pebble, or boulder substrate. They seldom leave the bottom except when disturbed. Also occur in still waters. Sometimes stays partially buried in fine substrate. Enter flooded forest (Roberts, 1993; Serajuddin and Pathak, 2012; Coad, 2015; Ali *et al.*, 2018).

10. *Crucian carp* (*Carassius carassius*) (Linnaeus, 1758): Shokhatt

The local name in Deralok is Shokhatt. This species has no economic importance because of its bad taste and unfavorable for people. It is the smallest family of carp that can be easily distinguished from common carp due to lack of barbel. They live in lakes or rivers. This little fish head, mouth and reverse lips. Tends to be a rusty bronze color with an orange belly. Inhabit and sweeping of environment affecting on the growth and life of local fishes. Because all local Iraqi fish don't tolerate turbidity because this type is nutritious besides the and in some cases capable of reproduction with other types of Cyprids who make sterile individuals. They usually live in freshwaters, but often enter estuaries. Formation of small schools. Oviparous, eggs are non-adhesive and pelagic. This fish is the head of Tigris & Euphrates fishes. Durable and resistant fish that thrive in a wide variety of aquatic habitats. Compete vigorously with other most cyprinid fish species for space and food. They seem to occupy an unexpected environmental niche or even lead to unexpected changes in the behavior of indigenous species. Strong predators on phytoplankton, zooplankton and the eggs of local fish. Seems to be a serious competitor of local fish species. This type can tolerate the organic pollution. Can live in acidic waters where the pH can be as low as 4. Also very tolerant of pollution, especially organic types.

Introduced to Iraq by unintentional release from Turkish dams throw 2005 (FAO, 2009; Radi, 2012; Mizory, 2016).

11. *Liza abu* (Heckel, 1843): Beyah

The local name in Deralok is Beyah. This type has little economic importance for people because it used usually for making fish diets because of its small size. Lives always in

schools. Males somewhat smaller than females and they mature between (1-2) years before female. Spawns several million eggs. Juveniles around 2.5 cm length feed on zooplankton until about 3 cm, then it convert its food to benthic animals and plants, while the adults are sediment, detritus and filter feeders (Kritsky *et al.*, 2013).

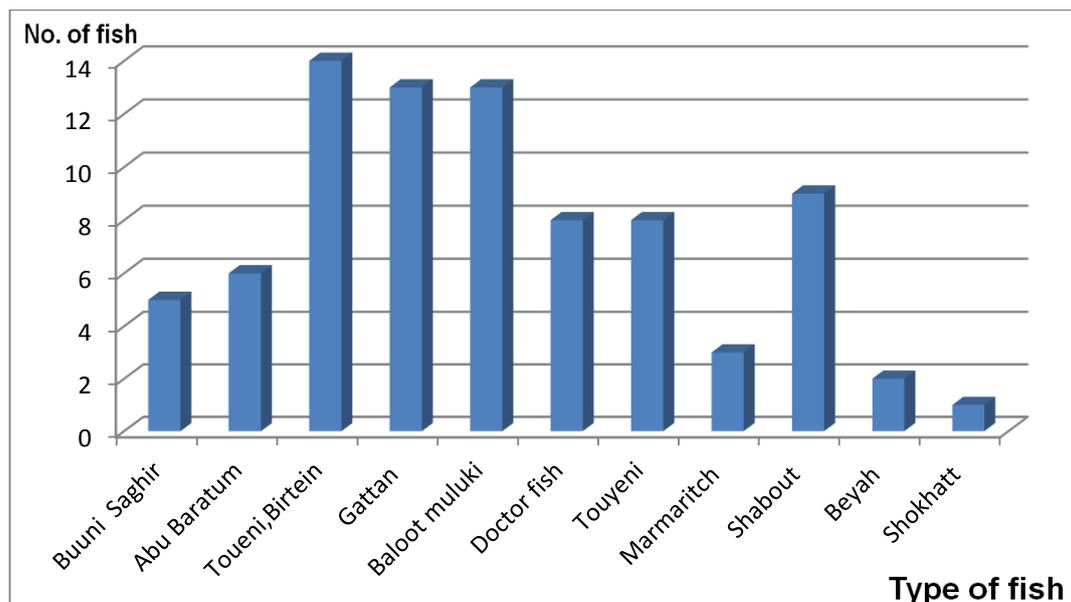


Fig. (2): shows the number of collected fish from Deralok throw survey period.

So, in this season continuously of appearing of local species (Doctor Fish, Gattan, Shabout, Toueni-Birtein, Balootmuluki, Toueni, Abu

Baratum & Buuni Saghir) were found within the absence of some local species which are (Beyah, Shokhatt & Marmaritch).

Table (5): shows the number of collected fish from Deralok throw survey period.

No.	English name	Scientific name	No. of fish
1	Buuni saghir	<i>Cypinion kais</i>	5
2	Abu baratam	<i>Barbus barbulus</i>	6
3	Toueni, Birtein	<i>Barbus belayewi</i>	14
4	Gattan	<i>Luciobarbus xanthopterus</i>	13
5	Baloot muluki	<i>Chondrostoma regium</i>	13
6	Doctor fish	<i>Garra rufa</i>	8
7	Touyeni	<i>Capoeta trutta</i>	8
8	Marmaritch	<i>M. mastacembelus</i>	3
9	Shabout	<i>Barbus grybus</i>	9
10	Beyah	<i>Liza abu</i>	2
11	Shokhatt	<i>Carassius carassius</i>	1

Figure 2 and Table 5 show the number of fish collected from the Deralok survey. The highest percentage of Toueni, Birtein fish was recorded while the lowest was recorded Shokhatt fish.

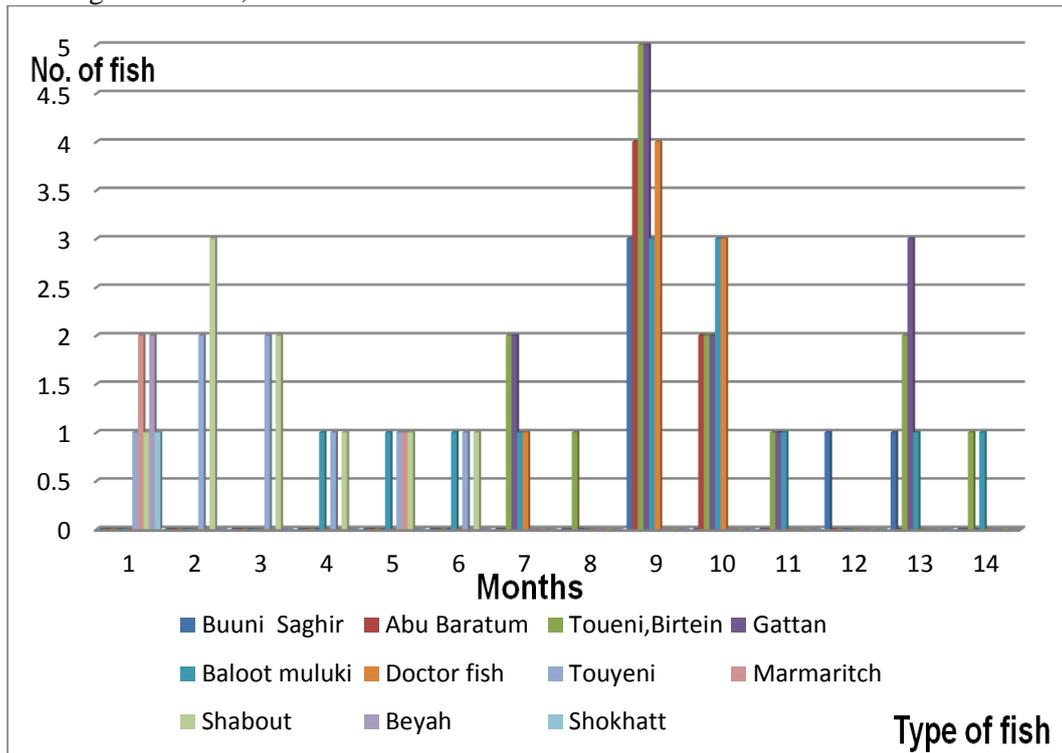


Fig. (3): Shows the fluctuation of fish from Deralok through different periods.

Table (6): shows the fluctuation of fish from Deralok through different periods.

No	Fish Type	Months													
		2013					2014					2015			
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	Buuni Saghir	0	0	0	0	0	0	0	3	0	0	1	1	0	
2	Abu Baratam	0	0	0	0	0	0	0	4	2	0	0	0	0	
3	Toueni, Birtein	0	0	0	0	0	2	1	5	2	1	0	2	1	
4	Gattan	0	0	0	0	0	2	0	5	2	1	0	3	0	
5	Baloot muluki	0	0	0	1	1	1	0	3	3	1	0	1	1	
6	Doctor fish	0	0	0	0	0	1	0	4	3	0	0	0	0	
7	Touyeni	1	2	2	1	1	0	0	0	0	0	0	0	0	
8	Marmaritch	2	0	0	0	1	0	0	0	0	0	0	0	0	
9	Shabout	1	3	2	1	1	0	0	0	0	0	0	0	0	
10	Beyah	2	0	0	0	0	0	0	0	0	0	0	0	0	
11	Shokhatt	1	0	0	0	0	0	0	0	0	0	0	0	0	

Figure (3) and Table (6) shows the throwing of survey periods with the highest fish diversity and presence in September (as noted earlier in the introduction that the optimal growth time is from August to November, which may be due to the increase in Phytoplankton). While there is

less record in December and February, it is likely that the reason for this decline is the entry of fish in the period of hibernation due to the harsh winter because the Deralok area is one of the coldest areas in the province of Duhok and

sometimes even roads may be closed from snowfall.

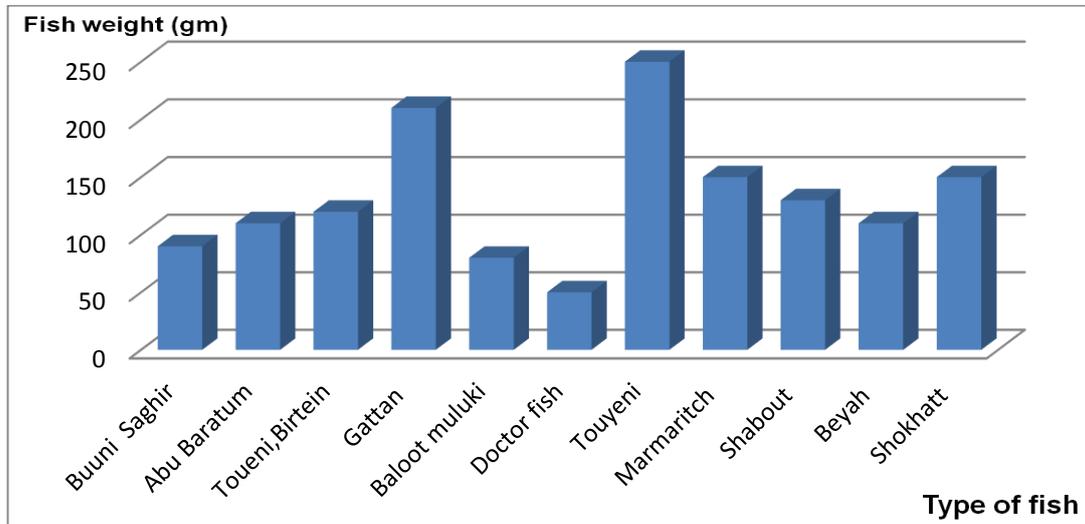


Fig. (4): shows the variation of average weight of the collected fish.

Figure (4) shows the highest weight recorded for Touyeni fish (210g) while the lowest weight for the doctor fish (50g) was recorded.

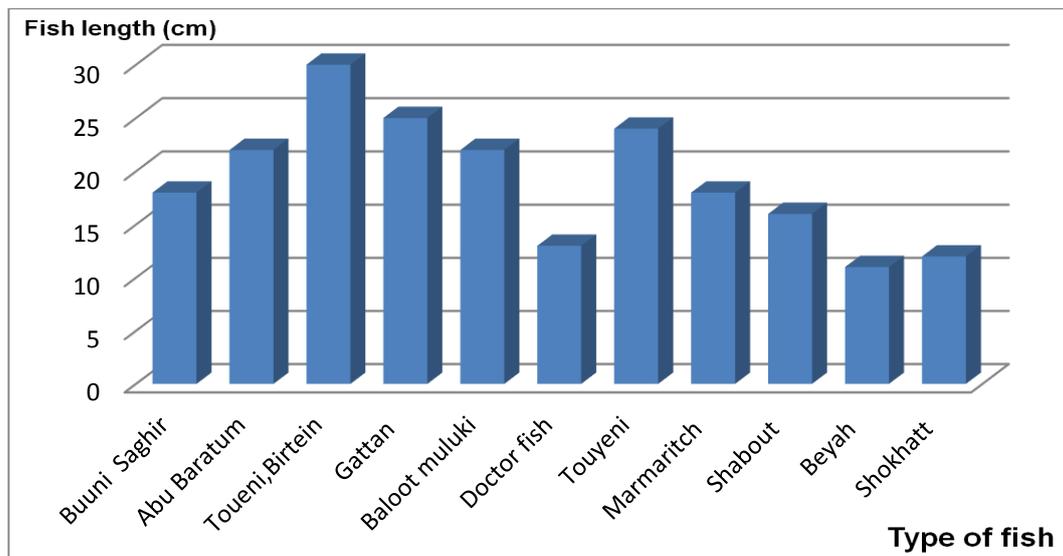


Fig. (5): shows the variation of average length of the collected fish.

Figure (5) shows the variation of the average lengths of fish collected during the study period, the highest recorded length of Touyeni fish (30cm), while the lowest length of the Beyah fish (11cm).

The most species recorded in the study of Agha (2017) are native species except five species are exotic included *C. auratus*, *C. idella*, *C. carpio*, *H. fossilis* and *S. caspius* when the present findings compared with Abdullah (2002)

recorded only one species of exotic fishes from Greater Zab River (*H. fossilis*), and Abdullah (2013) recorded four species of exotic fishes from Darbandikhan Lake (*Carassius auratus*, *Cyprinus carpio*, *Hemiculter leuciscus* and *Hypophthalmichthys molitrix*). Coad (2010) pointed at that there are thirteen species of exotic fishes in the Tigris-Euphrates Basins including the four species which we record in the present study.

Abdullah (2002) recorded 25 fish species from Greater Zab River included 19 species belonging to Cyprinidae family and recorded 18 fish species from Lesser Zab River included 15 species belonging to Cyprinidae family. Abdullah (2006) recorded 23 species of fishes of Dokan Lake which are 18 species belonging to Cyprinidae family.

The distribution of fish in the Great Zab River is characterized by the nature of the river and the water levels varying from year to another and season to another, depending on the fishing time, location and method, and may be due to climate changes that affect the distribution of the fish. The physical dispersion of water may change in rivers, such as the distribution of new fish in this river.

CONCLUSIONS

There is great variation of fisheries through seasons. All collected fishes were recorded from different Deralok river stations (upstream-midstream-downstream). So, this means the collection site does not affect the fish distribution. All the collected fish are juveniles with the possibility to sex distinguishing according to the ichthyology practical methods. We record both sexes (male and female) for collected species. The nature of aquatic body of Deralok is same from up-mid-downstream, the rocks, plants and water currents. There is distinguishing difference of the economic importance of fish according to the consumer favorable. Feeding habits of collected fish show fluctuation depending on fish species. We recommend to construct the dam and the over pass without any possible problems.

RECOMMENDATIONS

There is an urgent need to conduct a survey of most of the water bodies of the Kurdistan Region & It is necessary to follow the beginning of the spread of Shokhatt fish *Carassius carassius*, which recorded during the study period because it is considered a fish harmful to the environment and fish of the region Because they feeding habits of this fish on the eggs of some local fish species or / and they dig up the bottom (bottom diverter).

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