FISH ASSEMBLAGE STRUCTURE IN GREATER ZAB RIVER NEAR ASKI-KALAK, ERBIL

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ABSTRACT

The study was conducted at the Greater Zab River at Aski-Kalak City in three stations during the period from November 2020 to October 2021.The lowest water temperature value was 9.2°C at January while the highest value was 30 °C during July 2021. Salinity values ranged between 0.21 at January to 0.49 g/l during July 2021. Dissolve oxygen was high which range between 12.5 and 5.2 mg/l during December 2020 and July 2021 respectively. A total of 2368 specimens with a total weight of 848.97Kg were collected. These fishes were represented by 28 fish species belong to 7 families.The dominance commercial fishes (15 species) were recorded with a total weight of 775.56 kg formed 91.35% of a total fish catches. While, non – commercial fishes (13 species) were recorded with a total weight of 73.41kg represent 8.65% of total fishes catches. Fish species of *Chondrostoma regium* were occurred to be dominating of fish number and represented by 11.9% followed by *Capoeta trutta* (11.8%) and *Arabibarbus grypus* (11.1%) of total fish caches. Also, fish species of *Luciobarbus kersin* come at the first of total weight of fish catches and formed 18.15%, then followed by *Arabibarbus grypus* (16.12%) and *Cyprinus carpio* (7.95%). Finally, fishes of *Alburnu spallidus* formed the lowest in fish number within 0.2% and in fish total weight was *Garrarufa* within 0.01% of total fish catches. Thepresent study concluded that Greater Zab River within freshwater, good airing and a favorable habitat for different fish species, more of that, there was considerable stock of commercial Iraqi fishes.

Keywords: Fish, Greater Zab, Cyprinid

تركيب مجتمع الأسماك في نهرالزاب الكبير بالقرب من مدينة أسكي– كلك، أربيل

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المستخلص

درست طبيعة تركيب مجتمع الاسماك في نهر الزاب الكبير بمدينة أسكي– كلك في ثلاث محطات خلال الفترة من تشرين الثاني 2020 إلى تشرين الأول 2021. تم قياس درجة حرارةالمياه وكانت أقل درجة الحرارة 9.2 ْم في كانون الثاني وأعلى درجة الحرارة كانت 30 ْم في تموز 2021. سجلت أقل ملوحة (0.21غم/ لتر) أثناء كانون الثاني وأعلى قيمة (0.4غم/ لتر) في تموز 2021. كانت مستويات الأوكسجين المذاب عالية وسجلت أعلى تركيز(12.5ملغم/ لتر) وأدنى تركيز (5.2ملغم/ لتر)في كانون الأول 2020 و تموز2021على التوالي. تم جمع 2368 نموذجاً بوزن كلي848.97 كغم. اشتمل المصيد الكلي 28 نوعا من الأسماك تعود الى سبع عوائل, توزعت الأسماك المصيدة بين الأنواع التجارية (15 نوعا) و تميزت بسيادة واضحة وبلغ مجموع اوزانها الكلية 775.56 كغم و مثلت نسبة 91.35 % من المصيد الكلي, و بين الأنواع غير التجارية (13 نوعا) و بلغ مجموع اوزانها الكلية 73.41 كغم و مثلت نسبة 8.65 % من المصيد الكلي. احتلت اسماك *Chondrostoma regium* المرتبة الاولى من ناحية الاعداد بنسبة (11.9%), و تبعتها في ذلك اسماك *Capoeta trutt* (11.8%) ثم جاءت اسماك *Arabibarbus grypus* (11.1%). كانت اعلى الاوزان من نصيب اسماك *Luciobarbus kersin* بنسبة 18.15% من المصيد الكلي, تبعتها اسماك *Arabibarbus grypus* (16.12%) واسماك *Cyprinus carpio* (7.95%). بينما جاءت اسماك *Alburnus pallidus* بالمرتبة الاخيرة اذ سجلت أقل الأعداد بنسبة 0.2%، و جاءت اسماك *Garra rufa* بأقل الأوزان بنسبة 0.01% من المصيد الكلي. أظهرت نتائج الدراسة الحالية بان مياه نهر الزاب الكبير ذات تهوية جيدة وهناك أعداد و أوزان وفيرة للأسماك التجارية.

الكلمات المفتاحية: أسماك, الزاب الكبير, الشبوطيات

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INTRODUCTION

The river is widely used for human consumption, agricultural, trade and industrial activities, transportation, electric power plants and recreation. The main agricultural lands extend along the river banks (17). Rivers are increasingly exposed to many changes in water quality due to climatic conditions and human interventions such as pollution, agricultural and industrial activities and other abnormal changes that have directly or indirectly affected the fish assemblage structure through changing the water quality (19).Aquatic resources play an important role in developing countries, because they not only contribute to the daily livelihood of the population, but also provide significant nutrition for the local communities, as in Southeast Asia (24). Fish are a major source of protein for many people all over the world, as they are at the top of the aquatic food chain (18, 26). In a comparative study of the parasites that infect some species of fish in the Greater Zab River (5) indicated that the presence of 25 species of fish.While indicated in study that conducted of the Greater Zab River in Aski-Kalak City, presence of 27 species of fish(7). Whereas in a study conducted of Greater Zab River in Deralok Hydropower Plant indicated the presence of 11 species of fish (16). Temperature, salinity, pH and nutrient concentration affect the structure of fish communities and lead to increase bioactivity of fish interactions (11, 12). The importance of these factors have led to differences in control and conservation of these communities (14). All studies on fish distribution, abundance, composition, and population dynamics are critical for providing a very clear phenomenaon ecological and nature of fish structure in environment (1). These studies were showed and gave information's on fish stock assessments, commercial and non-commercial fishes, as well as, this information which support us to take care of fishes as rich national resources and to be as a basic for our planning for future to reserve this fortune (21). The local studies were characterized by their limitations, those that dealt with evidence of diversity to assess the composition of fish communities. Due to the lack of fish ecological studies on the Greater Zab River near Aski- Kalak the present study aims to give an example for describing the nature of the fish community ,dominant and abundance of species in the Greater Zab River through the use of biological indices. As well as, study of the environmental changes in the region to identify their impact on the presence of species.

MATERIALS AND METHODS

Study area: Greater Zab River is located to the east Tigris River at the north part of Iraq (Kurdistan Region). It is situated between 36˚-37˚north latitudes and 43˚- 44˚ east longitude (Fig. 1). This river is originated from a location between the mountain area of Urmea in Iran and Wan Lake in Turkey and then directed to the western south and near to Amedi, it passes the Iraqi border then extends through Duhok and Erbil governorates. The length of Greater Zab River from the sink to the point of pouring into Tigris River in Guer sub district is 392 km. The mean depth and width of river in this site is about 3m and 60m respectively(26). During this study samples were collected in three sites; the first was Girdarasha located on the Greater Zab River, next to Ifraz village in the Kawrgosk district, about 15 km away from Aski-kalak . Domestic effluents from Kawrgosk village are discharged straight into the river, second site was Aski-kalakis situated on the major Geater Zab River in the Aski-Kalak sub-district center, near sand quarries and adjacent to the old bridge, agriculture activities are prevalent at this place, which is located in the south western section of the Khabat district and third site was the village of chamadbz is near to the Greater Zab River, about 10 km away from Aski-kalak City. Generally, the width, and depth of river near studied sites was 40 to 60m and 2-4m respectively.

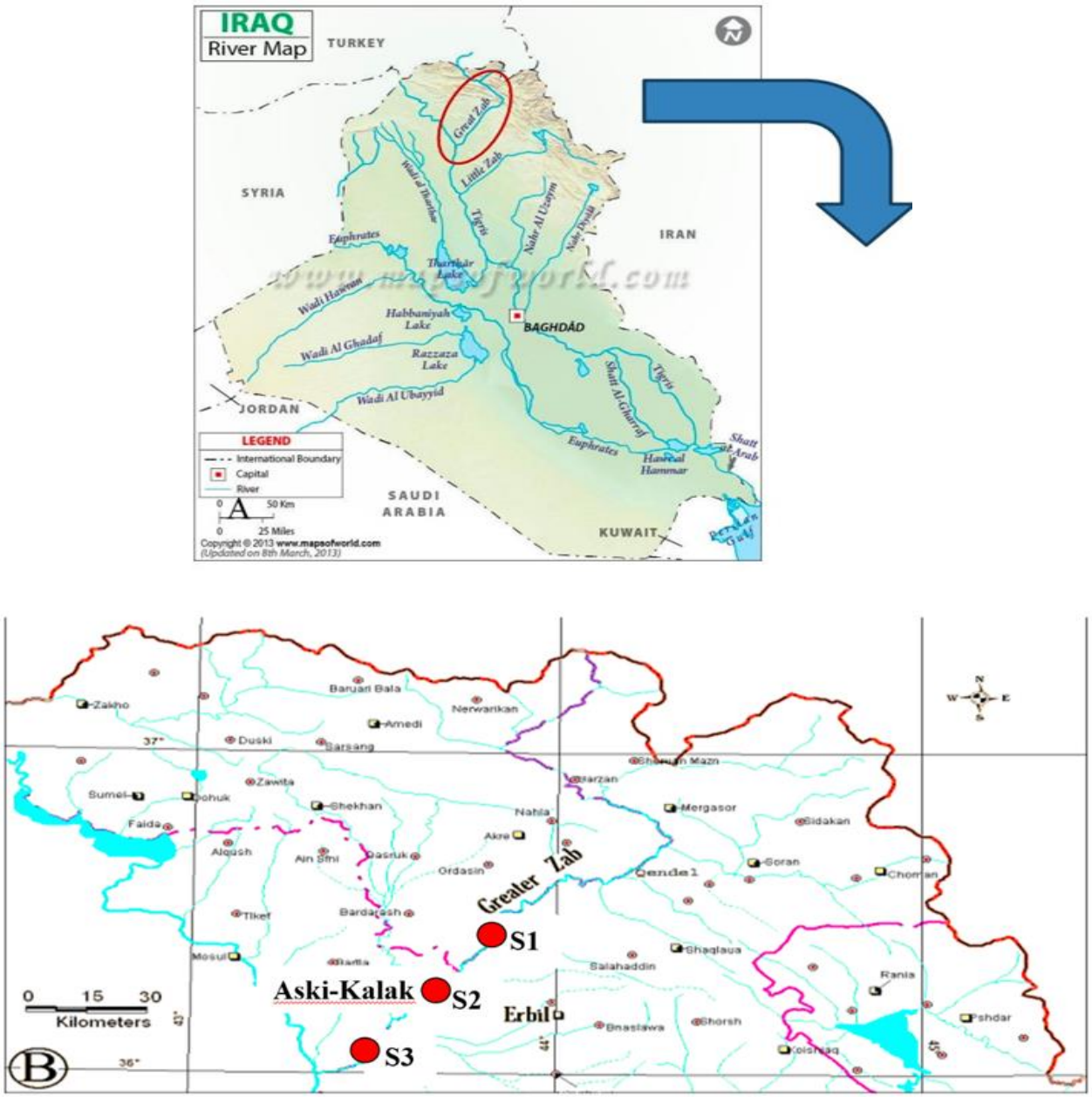

Figure 1. A-Map showing the lakes and revire routes in Iraq
B-Map of Geater Zab River with main branches

Fish collection: A total of 2368 specimens were collected monthly from three sites that were chosen of Greater Zab River at Aski-Kalak City near Khabat sub-district. Samples of fishes were collected using gill nets and cast nets with mesh dimensions of 5*5 mm. Chemo-physical parameters of water such as temperature, pH, dissolved oxygen salinity and transparency were recorded during the period of study.

RESULTS AND DISCUSSION

Figure (2) exhibited the monthly changes of the water temperature in the studied stations. The lowest temperature were 9.2, 9.8 and 9.5°C in January 2021 at the first, second and third stations respectively. whereas water temperature increased gradually to reach highest of 29, 30 and 29.6° C during July 2021 for the first second and third stations respectively.Water temperature is an important factor in any aquatic environments affecting on biological processes. In this study this variations may be due to changes in air temperature, differences in collecting times and water depth variation, and this result was similar to previous studies done by Ali (8) and Abdullah and Mhaisen (6).The seasonal changes of water temperature in the river were within narrow ranges in the winter season and expanded during the summer, which are the appropriate ranges that fish tolerate in the environment of water bodies interior.

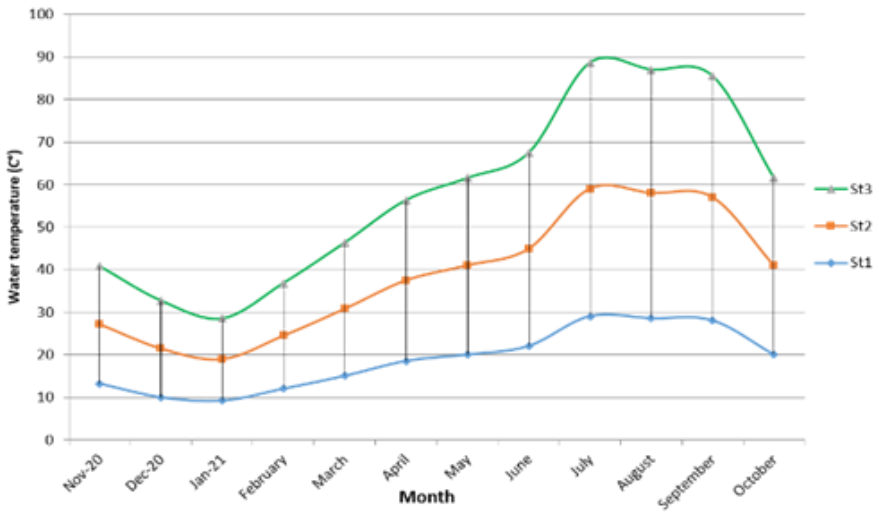

Figure 2. Monthly changes in water temperature of selected stations during the period of the study

Figure (3) indicated the monthly changes in salinity during the study period. The lowest values of salinity were recorded in November 2020 (0.21, 0.26 and 0.24g/l) for the first, second and third stations respectively, while the highest salinity values were recorded in July 2021 (0.45, 0.49 and 0.46g/l) for the first, second and third stations respectively, the fluctuation of the salinity of the river water between decreasing and relieving may be due to as a result of rain in the winter season, and a rise of salinity due to the evaporation of water during summer. Generally, salinity value was showed very slight changes period in sites and the results came in accordance with the known salinity value for Iraqi inland water (4,8).

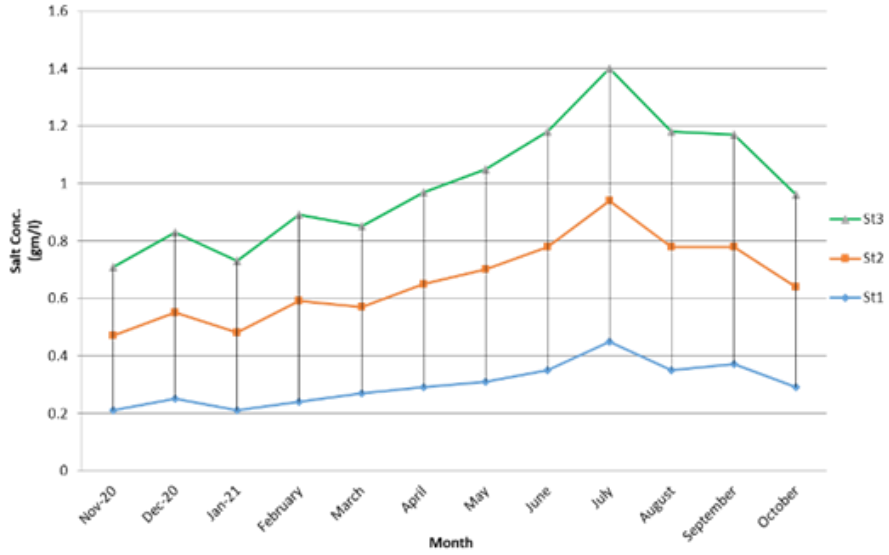

Figure 3. Monthly changes in salinity values of selected stations during the period of the study

Figure(4) revealed the monthly changes in dissolved oxygen of the study stations. The lowest oxygen values was recorded 7.8 mg/l in August 2021 for the first station, 5.2 mg/l in July 2021 for the second station and 7 mg/l in September 2021 for the third station. The highest oxygen values were 12.5 mg/l in December 2020 for the first station, 7.9 mg/l in January 2021 for the second station and 10.2 mg/l in December 2020 for the third station. Oxygen content of water is one of the important factors, and it is very necessary for all living organisms (25).The study showed a significant increase in the dissolved oxygen values, this is due to low temperatures and continuous mixing of water and the capacity of the surface area. This is consistent with many previous local studies that confirmed the nature of good ventilation of the inland waters(4).

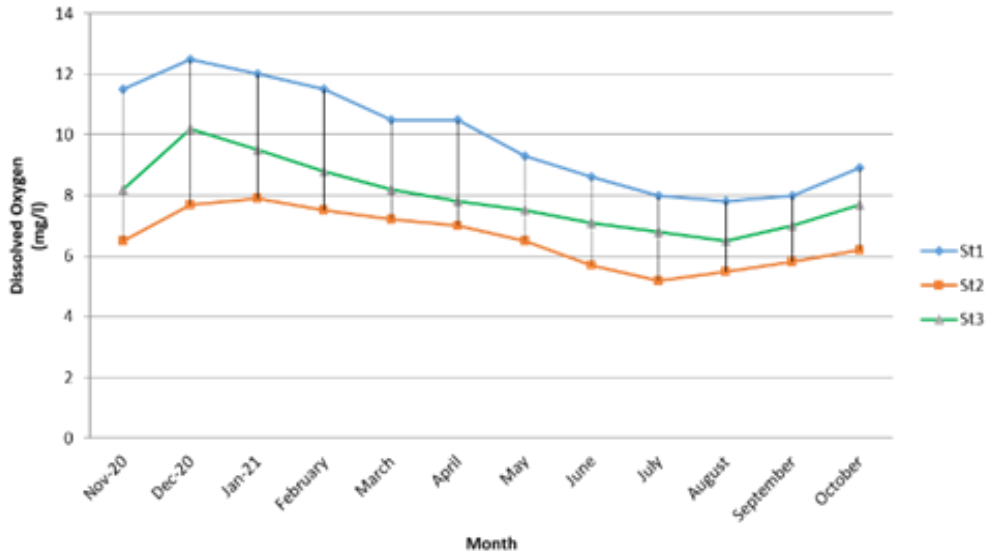

Figure 4. Monthly changes in dissolved oxygen of selected stations during the period of the study

Figure (5) presented the monthly changes in transparency values during the water column at the studied stations. The lowest permeability of the light were (17, 23 and 19) cm in March 2021 for the first, second and third stations respectively, while the highest values were (51, 62 and 57) cm in July 2021 for the first station, second and third stations, respectively. Water transparency is one of the most important physical factors affecting the variation and composition of the fish community, especially those that depend for their feeding on sight or the sense of smell (15). Due to low water levels and increased concentration of suspended materials that resulted from high productivity which reduces light penetration.While the higher level due to the large rainfall and the presence of many gravel and sand extraction plants, as well as the existence of water purification projects for the city of Erbil, where this river is the largest source of it (6).

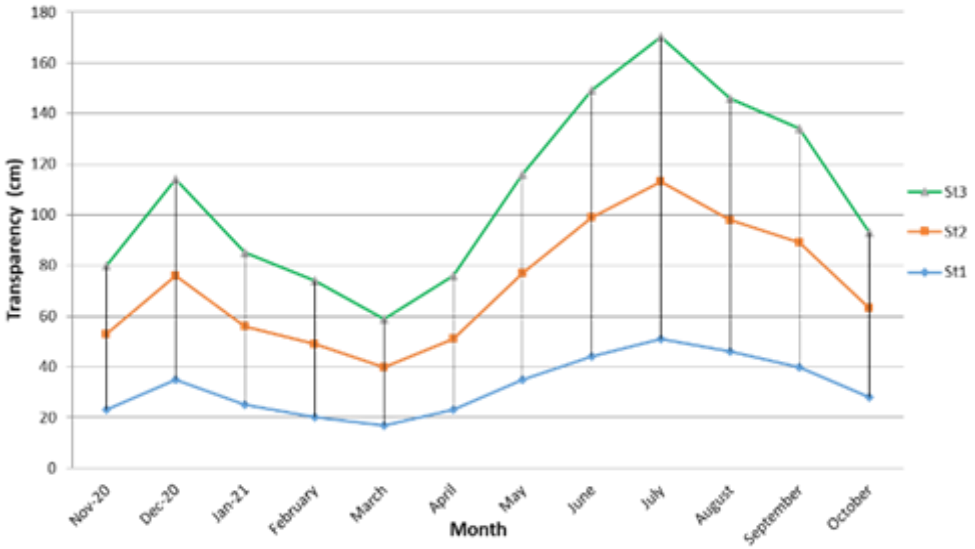

Figure 5. Monthly changes in transparency values of selected stations during the period of the study

Figure(6) indicated the monthly changes in the pH values for the studied stations, which recorded during the study period. The lowest values of pH were recorded in July 2021 (7, 6 and 6.6) for the first, second and third stations respectively, while the highest pH values were recorded in February 2021 (9.5, 7.5 and 8) for the first, second and third stations respectively.pH value of Greater Zab River in study sites during of most studied period was alkaline , this result agreed with Ali (10), the results are agree with the finding that recorded by Ali (9) and Shekha (23) in the same river.

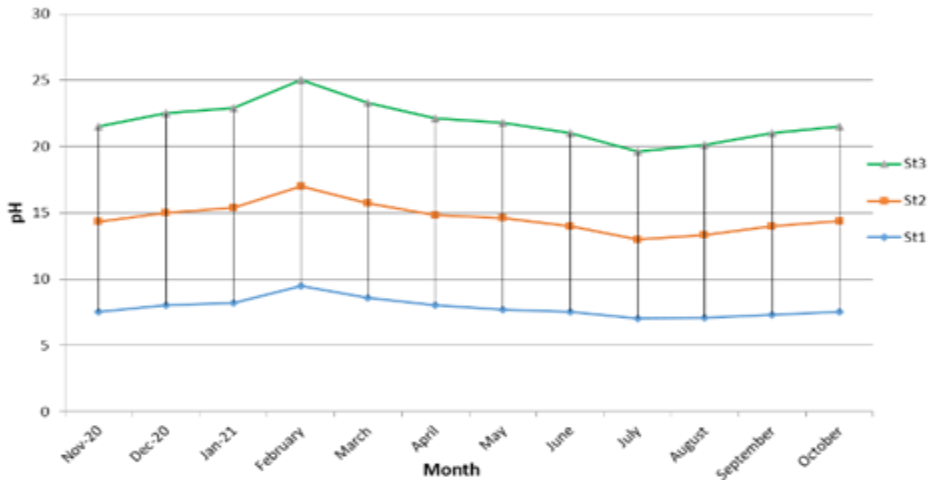

Figure 6.Monthly changes in pH values of selected stations during the period of the study

A total of 2368 of fishes with a total weight of 848.97 kg were collected. These fishes were represented by 28 fish species belong to 7 families, including 22 species of fish of the Cyprinidae family, one species for each Mugilidae, Siluridae, Heteropneustidae, Bargridae, Sisoridae and Mastacembelidae (Tables 1 and 2). The highest numbers of fishes recorded were represented by *Chondrostoma regium* reached (11.9 %) from total fish cachedin the study sites, followed by *Capoeta trutta* which recorded(11.8 %) then come *Arabibarbus grypus* (11.1%) from total number. Lowest values were recorded by *Alburnus pallidus* and represented (0.2%) followed by *Garra rufa* represented (0.3%) from total fish number.Also, fish species of *Luciobarbus kersin* come at the first of total weight of fish catches and formed (18.1%), then followed by *Arbibarbus grypus* (16.1%), *Cyprinus carpio* (7.9%). Finally, Lowest values were recorded by *Garra rufa* reached 0.01% of total weight fish catches in the study sites (Table 2).The results of present study, agree with research occurred of same river by Abdullah and Mhaisen (5), same species registered and Cyprinidae family was dominant, In the study of Agha (7) which was conducted in Greater Zab River 27 species of fish were recorded. The present results agree with some of past local research that found Cyprinidae fish species were the dominant (2,3). The present results agree with research occurred in some inland water bodies about the dominance of the cyprinidae family(12).Table (3) showed a decrease in the number of fish species caught to 12 in November 2020 and a rise to 20 species in August of 2021.It is also noted that the lowest percentage of fish number of the total catch was 5.9% in January of the year 2021 and the highest percentage was 11.8% in August 2021. As for the weight, it decreased by 4.2% in December 2020 and returned to increase by 14.1% of the total catch in the month of August of the year 2021.It is noted from it that there is a decrease in the presence of fish species, numbers and weights in the cold months and an increase in their abundance during the warm and hot months.The abundance of fish species, their numbers and weights with the rise in water temperature may be due to the presence of large fish for the purpose of reproduction, as well as the presence of all species of resident fish prevalent as a result of the increased feeding activity(21).Distribution of the total catch among commercial species (15 species) with a total number of 1810 fish and total weight of 770.58 kg, among non-commercial fish (13 species) with a total number of 558 fish and total weight of 78.39 kg (Table 4). It was also noted that the lowest number of commercial fish was 90 fish during February 2021 and the lowest weight of commercial fish was 32.81 kg during December 2020, while an increase in the number was recorded by 228 fish during July 2021 and the weight is 109.33 kg in August of the same year. As for non-commercial fish, the lowest number of 5 fish and weighing 0.30 kg, was recorded in November 2020, while the highest numbers were 62 fish during May 2021, and the weights were 15.40 kg during June of the same year. A fluctuation in the amount of catch per unit effort during the study period, the lowest

value was recorded at 11.97 kg/hour for total catch, 10.93 kg/hour for commercial catch in December 2020 and a value of 0.1 kg/hour for non-commercial catch in November of the same year (Table 5), While the amount of catch increased in the subsequent months the highest amount of total catch was recorded, with a value of 38.75 kg/hour, for commercial catch with a value of 36.44 kg/hour in August and for non-commercial catch with a value of 5.13 kg/hour in June of the year 2021.Expresses catch per unit effort (CPUE) the number (individuals) or weight of fish (kg) caught during the unit time / hour (20), it is one of the most important indicators that indicate the condition of the fish community (and includes the number of fishermen, the number of boats, the number of fishing days, the types of nets and the number of their throws, as well as the lunar phase) is very important during night fishing (13). Similar results were recorded for the decrease in the amount of fish caught in the cold months, the peak of which increased with the rise in water temperature with the beginning of spring and during the summer, which may be due to the increased feeding activity of the fish or their movement during or after spawning (21).The fluctuations in the amount of fish caught may be attributed to many factors, including catch effort intensity and the movement of fish for feeding and reproduction, in addition to various other environmental influences that play a major role in the distribution and spread of fish especially the increase in water temperature (2).The current results indicate a decrease in the amount of fish caught in the cold months and its peak increased with the rise in water temperature with the beginning of spring and during summer. The current results are close to the above in some previous local studies(22).The fluctuation in the quantity of fish caught may be attributed to several factors, including the catch effort intensity and the movement of fish for feeding or reproduction, in addition to other important environmental influences in the distribution and spread of fish,it is consistent with the current results.

Table 1. Scientific and common name of fishes collected at Greater Zab River from November 2020 to October 2021

Scientific name	Local name	Family
***Acanthobra mamarmid*Heckel, 1843**	**Semnan arrez**	
****Arabibarbus grypus*(Heckel, 1843)**	**Shaboot**	
***Alburnus pallidus*(Heckel, 1843)**	**Semnan**	
***Barbus lacerta*(Heckel, 1843)**	**Shaboutmoraqqat**	
****Capoeta damascina*(Valenciennes, 1842)**	**Demashqii**	
****Capoeta trutta*(Heckel, 1843)**	**Touyeni**	
****Carassius auratus*(Linnaeus, 1758)**	**Samakzahabi**	
****Carassius carassius*(Linnaeus, 1758)**	**Carsin**	
***Carasobarbus kosswigi*(Ladiges, 1960)**	**-**	
****Carasobarbus luteus*(Heckel, 1843)**	**Himri**	
****Chondrostoma regium*(Agassiz, 1832)**	**Balootmuluki**	**Cyprinidae**
****Ctenopharyngodon idella*(Valenciennes, 1844)**	**Carp Oshaby**	
***Cyprinion kais* (Heckel, 1843)**	**Bunnisaghir**	
***Cyprinion macrostomum*Heckel, 1843**	**Bunainikabir**	
****Cyprinus carpio* Linnaeus, 1758**	**Common carp**	
***Garra rufa*(Heckel,1843)**	**Karkurahmar**	
****Leuciscus vorax*(Heckel, 1843)**	**Shiliq**	
****Luciobarbus barbulus*(Heckel, 1843)**	**Abu-barattum**	
****Luciobarbus esocinus*Heckel, 1843**	**Bizz**	
****Luciobarbus kersin*(Heckel, 1843)**	**Gatan**	
****Luciobarbus subquincunciatus*(Günther, 1868)**	**Aboukhazzama**	
***Squalius cephalus*(Linnaeus, 1758)**	**Qashash**	
***Glyptothorax kurdistanicus*(Berg, 1931)**	**Saqanqwr**	**Sisoridae**
***Heteropneustes fossilis*(Bloch, 1794)**	**Abu- hakkam**	**Heteropneustidae**
****Silurus triostegus*Heckel, 1843**	**Jirri**	**Siluridae**
***Mystus pelusius*(Solander, 1794)**	**Abu-zummair**	**Bargridae**
***Planiliz aabu*(Valenciennes, 1836)**	**Khishni**	**Mugilidae**
***Mastacembelus mastacembelus* (Banks &Solander, 1794)**	**Marmarij**	**Mastacembelidae**

*** Commercial species**

Table2. Fishes collected from Greater Zab River according to their numbers and weights from November 2020 to October 2021

Scientific Name	Fish No.	(%)	Total Weight (Kg)	(%)	Total Length Ranges (cm)	Total Weight Ranges (gm)
Acanthobrama marmid Heckel,1843	156	6.6	9.55	1.1	8.5 - 45.0	11 - 90
**Arabibarbus grypus*(Heckel,1843)	263	11.1	136.9	16.1	10.0 - 80.0	10.5 - 4000
Alburnus pallidus(Heckel,1843)	5	0.2	1.25	0.14	10.0 - 18.0	12 - 100
Barbus lacerta Heckel, 1843	22	0.9	11.0	1.3	14.0 - 50.0	30 - 550
**Capoeta damascina*(Valenciennes,1842)	30	1.2	6.87	0.8	8.2 - 30.5	22.5 - 275
**Capoeta trutta*(Heckel, 1843)	280	11.8	59.50	7.0	10.8 - 50.0	15.5 - 500
**Carassius auratus*(Linnaeus,1758)	119	5.0	22.90	2.7	8.3 - 27.5	16.5 - 375
**Carassius carassius*(Linnaeus,1758)	65	2.7	20.36	2.4	6.1 - 23.5	7.5 - 175
Carasobarbus kosswigi(Ladiges, 1960)	26	1.0	0.56	0.06	5.2 - 14.5	5.5 - 25
**Carasobarbus luteus*(Heckel,1843)	63	2.7	8.93	1.0	9.5 - 25.0	12.5 - 205
**Chondrostoma regium*Agassiz,1832	282	11.9	35.61	4.2	8.6 - 29.3	10.5 - 200
**Ctenopharyngodon idella*(Valenciennes,1844)	16	0.7	30.95	3.6	25.5 - 57,0	195 - 2100
Cyprinion kais Heckel, 1843	112	4.7	10.34	1.2	13.6 - 29.5	40.5 - 180
*Cyprinion macrostomum*Heckel,1843	40	1.7	3.4	0.4	6.3 - 18.5	5.5 - 120
**Cyprinus carpio* Linnaeus,1758	88	3.7	67.51	7.9	6.4 - 50.0	7.5 - 3250
Garra rufa(Heckel,1843)	6	0.3	0.14	0.01	10.0 - 19.5	15.0 - 52.5
**Leuciscus vorax*(Heckel,1843)	70	2.9	46.06	5.4	15.0 - 57.5	120 - 1200
**Luciobarbus barbulus*(Heckel, 843)	164	6.9	49.36	5.8	20.0 - 75.5	50 - 2500
**Luciobarbus esocinus*Heckel, 1843	126	5.3	55.78	6.6	13.0 - 85.5	190 - 5500
**Luciobarbus kersin*(Heckel,1843)	197	8.3	154.13	18.1	11.0 - 85.0	85 - 4500
**Luciobarbus subquincunciatus*(Günther,1868)	25	1.0	43.10	5.0	20.0 - 40.0	950 - 2500
Squalius cephalus(Linnaeus,1758)	29	1.2	15.35	1.8	13.5 - 42.0	85 - 580
Glyptothorax kurdistanicus(Berg,1931)	33	1.4	0.22	0.4	12.5 - 18.0	50 - 80
Heteropneustes fossilis(Bloch,1794)	8	0.4	0.32	0.03	17.0 - 20.0	30 - 50
**Silurus triostegus*Heckel,1843	48	2.0	37.5	4.4	17.5 - 58.0	150 - 1100
Mystus pelusius(Solander,1794)	23	0.9	0.63	0.07	12.0 - 19.5	20 - 40
Planiliza abu(Valenciennes,1836)	36	1.5	4.07	0.5	15.0 - 23.5	40 - 150
Mastacembelus mastacembelus(Banks&Solander, 1794)	36	1.5	13.59	1.6	40.0 - 65.5	240 - 550
Total	2368		848.97			

*** Commercial species**

Table 3.Monthly changes of species, numbers and weights of fish caught at Greater Zab River from November 2020 to October 2021

Month	No. of species	Total no. of fish	(%)	Total weight of fish (Kg)	(%)
November 2020	12	163	6.9	65.8	7.8
December	13	172	7.3	35.9	4.2
January 2021	15	140	5.9	47.2	5.6
February	16	145	6.1	50.9	6.0
March	18	154	6.5	56.8	6.7
April	18	151	6.4	55.5	6.5
May	15	204	8.6	55.2	6.5
June	16	231	9.7	83.3	9.8
July	15	271	11.4	105.6	12.4
August	20	280	11.8	120.0	14.1
September	18	276	11.6	114.0	13.4
October	18	181	7.6	62.5	7.4
Total		2368		848.9	

Table 4.Number and weight of commercial and non-commercial fish caught at Greater Zab River from November 2020 to October 2021

Month	Commercial		Non-commercial	
	Fish No.	Fish Weight (kg)	Fish No.	Fish Weight(kg)
November 2020	158	65.48	5	0.30
December	126	32.81	46	3.12
January 2021	99	44.27	41	2.96
February	90	41.90	55	8.99
March	101	43.82	53	12.92
April	117	49.81	34	5.73
May	142	46.77	62	8.44
June	172	67.86	59	15.40
July	228	102.10	43	3.44
August	219	109.33	61	6.93
September	225	108.48	51	5.59
October	133	57.95	48	4.57
Total	1810	770.58	558	78.39

Table 5.Monthly changes in the total catch rates , commercial and non-commercial in the unit effort for fish caught from Greater Zab River from November 2020 to October 2021

Month	Total catches (Kg /hour)	Commercial catches (Kg /hour)	Non- commercial catches (Kg /hour)
November 2020	21.92	21.82	0.1
December	11.97	10.93	1.04
January 2021	15.74	14.76	0.99
February	16.96	13.97	2.99
March	18.90	14.60	4.30
April	18.51	16.60	1.91
May	18.40	15.59	2.81
June	27.75	22.62	5.13
July	35.17	34.03	1.14
August	38.75	36.44	2.31
September	38.02	36.16	1.86
October	20.83	19.31	1.52
Total	282.92	256.83	26.1

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