Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 29(6): 1019 – 1034 (2025)
www.ejabf.journals.ekb.eg

Morphological Study of Some Cyprinid Species from the Greater Zab River, Qandil Village in Kurdistan Region, Iraq

Gashaw F. Agha* and Shamall M.A. Abdullah
Department of Fish Health and Production, College of Agriculture Engineering Sciences, Salahaddin University-Erbil
***Corresponding Author: gashaw.agha@su.edu.krd**

ARTICLE INFO
Article History:
Received: Aug. 25,2025
Accepted: Nov. 2nd, 2025
Online: Nov. 21, 2025

Keywords:
Fish,
Cyprinidae,
Morphology,
Greater Zab,
Kurdistan

ABSTRACT
This study involved the collection of random samples of fish from the Cyprinidae family in the Greater Zab River, Qandil Village, from July 2024 to February 2025. To examine and evaluate the morphometric and meristic parameters, a total of 374 fish specimens were gathered and documented, comprising 11 species, including *Arabibarbus grypus* (24 specimens), *Capoeta damascina* (36 specimens), *C. umbla* (21 specimens), *Carasobarbus kosswigi* (21 specimens), *C. luteus* (18 specimens), *Cyprinion kais* (63 specimens), *C. macrostomus* (63 specimens), *Garra rufa* (18 specimens), *Luciobarbus barbulus* (50 specimens), *L. kersin* (18 specimens), and *Paracapoeta trutta* (42 specimens). Two such fields, morphometrics and meristics, are basic disciplines used by researchers attempting to characterize fish morphology and taxonomy. The current study was undertaken to investigate several morphometrics, like total length (TL), standard length (SL), snout length (SnL), fork length (FL), head length (HL), eye diameter (ED), pre-dorsal length (PDL), dorsal fin length (DFL), dorsal fin height (DFH), anal fin height (AFH), anal fin length (AFL), pectoral fin height (Pc FH), pelvic fin height (PFH), caudal fin length (CFL), minimum body length (Mn BL), maximum body length (Mx BL), and some important meristic characteristics. Consequently, our current findings indicate a direct correlation between the total length of cyprinids and all morphometric characteristics. There was little to no variation among species for meristic metrics. Consequently, our current study may be beneficial in the systematic classification and management of Cyprindae species within the region.

INTRODUCTION

Cyprinidae, commonly known as carp and minnows, is the largest family of freshwater fish in the world, with species distributed throughout Asia, Europe, North America, and Africa **(Nelson *et al*., 2016)**. A total of 1,784 valid species in 166 genera have been described within the family Cyprinidae, the most species-rich fish family, describing 207 species throughout a decade **(Fricke *et al*., 2025)**.

With 28 confirmed species, Cyprinidae is the largest freshwater fish family in Iraq; 28.3% of all freshwater fish **(Çiçek *et al*., 2023)**. In freshwater ecosystems, the

Cyprinidae family plays a vital role in human food, acts as prey for other fish, and is used in the aquarium trade, sport fishing, and scientific research. Some species of carp are commercially important. Cyprinids are particularly significant to the aquaculture industry in Iraq. The primary species used in warm water include *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*, and, to a lesser extent, *Hypophthalmichthys nobilis* **(Coad, 2010)**.

The family includes fish ranging from small (1cm) to very large (up to 3m), with some of the largest specimens found in Iraq. They are characterized by pharyngeal teeth typically arranged in one to three rows on each side, with a maximum of eight teeth per row. The counts and morphology of these teeth are often distinctive at the genus or species level. The fishes lack jaw teeth, exhibit various body forms from fusiform to compressed, and may have one to three pairs of barbels (with no more than two pairs in Iraqi species). Their bodies are covered in cycloid scales, while the head is scaleless, and they do not possess an adipose fin **(Coad, 2010)**.

Fish morphology can be quantitatively analyzed using morphometric and meristic methods, and both primary numerical methods are employed in the scientific description of fish species **(Barriga-Sosa *et al*., 2004, Pinheiro *et al*., 2005, Aminan *et al*., 2020, Kumaladewi *et al*., 2022)**. Morphometric techniques have successfully differentiated various fish species worldwide over the past 50 years **(Stiasny *et al*., 1996, Dwivedi & Dubey, 2013, Kumaladewi *et al*., 2022)**. Morphometrics is a technique used in ichthyological and taxonomic studies to characterize fish body shape, including length ratios and fin measurements. It aids in species identification and utilizes measurable components of fish anatomy **(Saroniya *et al*., 2013)**.

In the Greater Zab River, the presence of fish species belonging to the family Cyprinidae has been heavily reported **(Abdullah, 2002; Agha, 2017; Mizory & Abdulrahman, 2019; Agha *et al*., 2021, 2023; Sediq & Abdulla, 2024; Bilal & Nasraddin, 2025; Al-Muffti & Abdullah, 2025)**. **Agha (2017)**, **Ali and Abdullah (2019)** and **Namiq and Mahmood (2019)** and others addressed the morphology of some cyprinids detected in the region. This study was conducted to establish baseline data on the morphometric and meristic parameters of Cyprinidae species from the Greater Zab River, Qandil Village. A morphometric approach was employed to analyze the external morphology of fish, yielding significant information for the identification of fishery units to support further conservation and management efforts.

MATERIALS AND METHODS

1. Collection of fish

Fish samples were collected from the Greater Zab River, Qandil Village, between July 2024 and February 2025 (Fig. 1). Qandil Village is situated on the Greater Zab River northeast of Erbil City, approximately 60km away. After being stored in an icebox, the samples were placed in the Agricultural Engineering Sciences Laboratory at Limnology

College. Following **Coad (2010)**, measurements and counts were evaluated. All measurements on the specimen's left side were obtained using a digital caliper, accurate to the nearest 0.1mm.

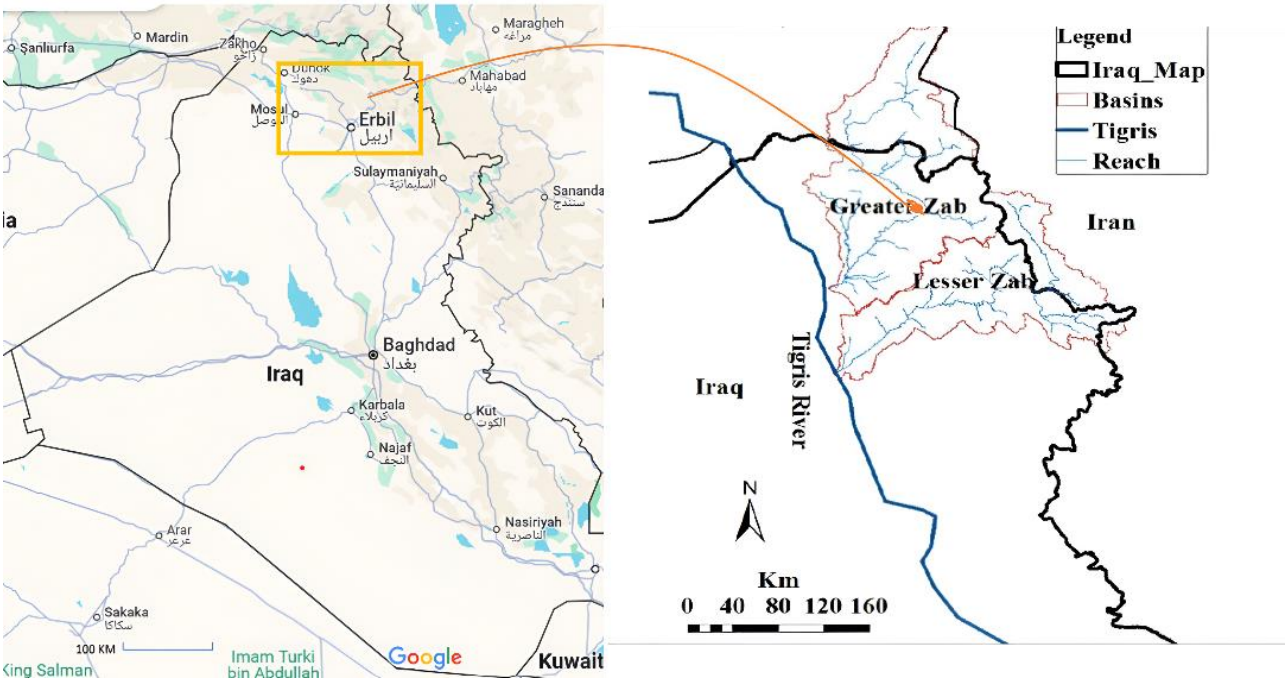

Fig. 1. A. Map of Iraq; B. Map of Geater Zab River (Google Maps)

2. Morphological characteristics

A one-meter measuring board graded in millimetres was used to calculate a total of 16 morphometric characteristics: Total length (TL), standard length (SL), snout length (Sn L), fork length (FL), head length (HL), eye diameter (ED), pre-dorsal length (Pre DL), dorsal fin length (DFL), dorsal fin height (DFH), anal fin height (AFH), anal fin length (AFL), pectoral fin height (Pc FH), pelvic fin height (PFH), caudal fin length (CFL), minimum body length (Mn BL), and maximum body length (Mx BL).

This research applied morphometric characteristics for analysis and inter-references, whereas meristic qualities offered supplementary insights. According to **Coad (2010)**, nine meristic traits were recorded through direct observation. The abbreviations for meristic traits are lateral line scales (LL), scales over lateral line (ALL), scales under the lateral line (BLL), dorsal fin rays (D), anal fin rays (A), pectoral fin rays (Pc), pelvic fin rays (P), barbels (B), and gill rakers (GR). To illustrate the morphological differences between species, photographs of Cyprinidae species which possessed a variety of traits were utilized.

3. Statistical analysis

Statistical computations have been performed for each of the 11 cyprinids, including the mean, standard deviation, regression equation, and correlation coefficients. Morphometric parameter regression equation: The following formula has been used for the regression approach on several morphometric parameters:

$Y = a + b X$

Where, Y represents several morphometric variables, such as standard length, fork length, and head length; "a" signifies the constant value; and "b" indicates the regression coefficient, with X indicating the total length **(Snedecor & Cochran, 1967)**.

RESULTS

A thorough examination of all Cyprinidae species present in the Greater Zab River, Qandil Village, including precise morphometric and meristic analysis of samples, has not been conducted by previous ichthyologists. The present study described 11 species of the Cyprinidae family, including *Arabibarbus grypus*, *Carasobarbus kosswigi*, and *C. luteus* belonging to the subfamily Torinae; *Capoeta damascina*, *C. umbla*, *Cyprinion kais*, *C. macrostomus*, *Luciobarbus barbelus*, *L. kersin*, and *Paracapoeta trutta* belonging to the subfamily Barbinae; and *Garra rufa* which belongs to the subfamily Labeoninae. The Cyprinidae is a predominant family, as evidenced by prior research conducted at the Greater Zab River Cyprinidae (**Abdullah, 2002; Agha, 2017; Mizory & Abdulrahman, 2019; Agha *et al*., 2021, 2023; Sediq & Abdulla, 2024; Bilal & Nasraddin, 2025)**.

The study documented 16 morphometric characteristics and nine meristic counts for each fish species. The morphometric characteristics of the Cyprinidae species exhibited a proportional increase in the total length of the examined fish, as presented (mean ± S.D.) in Table (1). The mean ± S.D. values of the morphometric characteristics of the specimens, encompassing total length, standard length, fork length, head length, snout length, eye diameter, pre-dorsal length, dorsal fin length, dorsal fin height, anal fin height, anal fin length, pectoral fin height, pelvic fin height, minimum body depth and maximum body depth, were documented for all cyprinids collected. As the length of the fish increased, the morphometric parameters similarly elevated across all cyprinid species.

The practical aspects of fish morphology that aid in the description of new species encompass morphometric and meristic characteristics **(Strauss & Bond, 1990)**. Morphometric and meristic measures play a crucial role in determining a species' taxonomy **(Roy *et al*., 2016)**. **Ujjania *et al*. (2012)** observed a positive correlation between morphometric factors and the increase in fish length. The study found a linear association between morphometric characteristics and total length. Morphometric relationships among species of the Cyprinidae family were analyzed through a regression model (Reg.) and correlation coefficients (r) between total length and various body measurements (Tables 2, 3). Fig. (2) shows the general morphology of all cyprinid species.

A. grypus exhibits a noteworthy positive correlation between total length and various other measurements, with the highest correlation observed with standard length and fork length (r=0.999). In contrast, the lowest correlation is found with eye diameter (r=0.875). In addition, meristic characteristics play crucial roles in specimen identification and experimental studies. In the genus *Capoeta*, a correlation has been noted between total length and various other measurements. The strongest correlation was observed with the fork length (r=0.999) of *C. damascina* and the standard length (r=0.999) of *C. umbla*. In contrast, the weakest correlation was found with the eye diameter (r=0.796) of *C. damascina* and the snout length (r=0.601) of *C. umbla*.

The genus *Carassobarbus* represents a relationship between total length and other lengths of fish body parts. The highest total length relationship of *C. koswigii* with standard length (r=0.993) and of *C. luteus* with pre-dorsal length (r=0.975). Meanwhile, the lowest total length relationship with eye diameter (r=0.399) is observed for *C. koswigii*, and for *C. luteus*, it is with pectoral fin height (r=0.403).

Table 1. Morphometric measurements of cyprinid species in the Greater Zab River/ Qandil Village

	A.grypus	*C.damascina*	*C. umbla*	*C.kosswigi*	*C. luteus*	*C. kais*	*C.macrostomus*	*G. rufa*	*L.barbulus*	*L. kersin*	*P. trutta*
	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD
TL.	34.8±14.8	27.7±8.71	30.37±7.61	19.40±2.24	18.25±1.89	15.60±1.26	17.20±2.51	10.1±0.86	29.73±11.8	27.95±8.79	23.43±6.09
SL	30±13.3	23.2±7.54	25.74±6.63	15.60±1.98	14.85±1.43	12.73±1.20	14.07±2.22	8.20±0.62	25.02±10.4	23.48±7.61	19.56±5.17
FL	31.9±13.6	24.9±8.13	27.77±7.19	16.83±2.00	16.12±1.48	13.82±1.25	15.29±2.31	9.10±0.79	26.75±10.8	24.92±7.76	20.93±5.49
HL	6.06±2.33	4.63±1.24	4.57±0.85	3.67±0.43	3.77±0.23	2.92±0.33	3.28±0.48	1.67±0.27	6.27±2.41	5.73±1.76	4.07±0.90
SnL	1.81±0.56	1.6±0.56	1.80±0.63	1.20±0.16	1.05±0.12	0.84±0.12	1.10±0.20	0.72±0.19	2.55±1.14	2.15±0.55	1.19±0.31
ED	0.96±0.14	0.81±0.12	0.87±0.08	0.81±0.09	0.88±0.04	0.71±0.17	0.77±0.12	0.37±0.05	1.00±0.13	1.00±0.09	0.83±0.13
PDL	13.6±5.62	10.62±3.14	12.10±3.37	7.33±0.83	7.27±0.80	5.82±0.70	6.07±0.79	3.62±0.44	11.83±4.57	11.47±3.70	9.01±2.31
DFL	3.51±1.42	3.03±1.16	3.66±1.03	2.80±0.33	2.88±0.30	2.99±0.38	3.82±0.62	1.36±0.15	3.29±1.14	3.25±1.07	2.84±0.81
DFH	4.48±1.52	3.58±1.07	4.01±0.90	3.53±0.36	2.95±0.28	2.75±0.18	2.64±0.31	1.47±0.22	5.09±1.36	5.13±1.53	4.53±1.16
AFH	4.1±1.64	3.44±1.24	3.80±0.98	3.43±0.59	2.65±0.21	2.39±0.33	2.37±0.33	1.25±0.20	4.22±1.54	3.93±1.10	2.90±1.11
AFL	2.08±0.82	1.63±0.64	1.84±0.41	1.77±0.24	1.17±0.20	1.47±0.17	1.67±0.68	0.78±0.08	2.00±0.77	1.90±0.68	1.46±0.50
PcFH	4.48±1.82	3.95±1.35	4.27±1.13	3.09±0.32	3.00±0.21	2.41±0.16	2.61±0.37	1.83±0.20	4.56±1.78	4.18±1.46	3.23±0.84
PFH	4.1±1.72	3.43±1.13	3.76±0.91	2.79±0.27	2.68±0.23	2.20±0.15	2.44±0.38	1.65±0.22	4.16±1.60	3.88±1.25	2.88±0.79
CFL	4.85±1.45	4.39±1.27	4.63±1.03	3.80±0.35	3.37±0.59	2.89±0.21	3.04±0.41	1.53±0.08	4.67±1.51	4.47±1.21	3.96±1.08
CPD	2.7±1.1	2.37±0.85	2.67±0.75	1.50±0.27	4.77±0.37	1.27±0.18	1.39±0.28	0.93±0.10	2.72±1.08	2.57±0.84	2.11±0.62
MaxBD	5.8±2.41	5.98±2.13	6.30±1.77	3.83±0.80	4.77±0.37	3.55±0.42	4.34±0.86	1.55±0.21	5.81±2.22	6.00±2.39	5.17±1.49

Table 2. Regression equation of morphometric characteristics of *A. grypus*, *C. damascina*, *C. umbla*, *C. koswigii*, *C. luteus* and *C. kais* in the Greater Zab River

	A. grypus		*C.damascina*		*C.umbla*		*C.koswigii*		*C.luteus*		*C.kais*	
	Reg.	r	Reg.	r	Reg.	r	Reg.	r	Reg.	r	Reg.	r
SL	Y=1.116x+1.451	0.999	Y=1.154x+0.809	0.998	Y=1.147x+0.843	0.999	Y=1.126x+1.831	0.993	Y=1.260x-0.465	0.956	Y=1.043x+2.313	0.990
FL	Y=1.688x+0.114	0.999	Y=1.071x+0.947	0.999	Y=1.057x+0.990	0.998	Y=1.110x+0.710	0.991	Y=0.968x-0.758	0.955	Y=1.001x+1.766	0.988
HL	Y=6.335x-3.606	0.995	Y=6.841x-4.007	0.975	Y=7.668x+4.684	0.859	Y=4.998x+1.047	0.959	Y=6.585x-6.554	0.814	Y=2.982x+6.893	0.771
SnoL	Y=4.105x-1.378	0.981	Y=2.170x+1.152	0.971	Y=0.812x+3.168	0.601	Y=2.125x+1.121	0.805	Y=1.066x+2.646	0.558	Y=1.039x+2.043	0.384
ED	Y=14.47x-7.872	0.875	Y=7.110x-1.181	0.796	Y=9.458x+3.670	0.837	Y=1.911x+2.114	0.399	Y=3.2x+0.94	0.558	Y=1.180x+2.081	0.625
PDL	Y=2.629x-0.823	0.996	Y=7.110x+0.818	0.988	Y=2.209x+3.634	0.977	Y=2.623x+0.109	0.971	Y=2.316x+1.411	0.975	Y=1.627x+6.130	0.900
DFL	Y=10.22x-1.111	0.980	Y=2.742x-1.477	0.926	Y=7.187x+4.087	0.968	Y=6.437x+1.375	0.936	Y=5.185x+3.297	0.821	Y=1.541x+10.99	0.469
D.F.H.	Y=9.592x-8.126	0.984	Y=6.977x+6.527	0.984	Y=8.352x+3.157	0.982	Y=4.922x+2.030	0.798	Y=6.012x+0.512	0.893	Y=4.937x+2.033	0.717

Cont. Table 2. Regression equation of morphometric characteristics of *A. grypus*, *C. damascina*, *C. umbla*, *C. koswigii*, *C. luteus* and *C. kais* in the Greater Zab River

	A. grypus		***C. damascina***		***C. umbla***		***C. koswigii***		***C. luteus***		***C. kais***	
AF. H.	Y=8.988x-2.054	0.992	Y=6.690x+4.605	0.955	Y=7.663x+1.251	0.986	Y=3.334x+7.967	0.869	Y=7.083x-0.546	0.777	Y=2.777x+8.974	0.727
AFL	Y=17.84x-2.219	0.988	Y=12.82x+6.804	0.936	Y=17.79x+2.419	0.962	Y=5.504x+9.649	0.578	Y=9.310x+7.387	0.968	Y=4.317x+9.247	0.573
PCFH	Y=8.055x-1.248	0.990	Y=6.446x+2.170	0.997	Y=6.476x+2.706	0.962	Y=6.622x-1.033	0.939	Y=3.636x+7.340	0.403	Y=5.721x+1.813	0.715
PFH	Y=8.516x-0.117	0.989	Y=7.649x+1.317	0.989	Y=8.156x+0.274	0.971	Y=7.757x-2.211	0.945	Y=7.076x+1.5	0.764	Y=2.044x+11.09	0.248
CFL	Y=10.09x-14.12	0.984	Y=6.420x-0.562	0.936	Y=7.714x+2.520	0.960	Y=5.013x+0.348	0.784	Y=2.451x+9.995	0.763	Y=3.647x+5.056	0.598
CPD	Y=13.33x-1.190	0.989	Y=10.14x+3.625	0.994	Y=10.02x+3.591	0.981	Y=7.977x+7.434	0.962	Y=4.381x-2.633	0.665	Y=4.293x+10.14	0.609
MaxBD	Y=5.966x+0.192	0.971	Y=4.049x+3.777	0.990	Y=4.039x+4.923	0.939	Y=2.498x+9.834	0.892	Y=12.19x-4.093	0.850	Y=1.982x+8.540	0.659

Table 3. Regression equation of morphometric characteristics of *C. macrostomus*, *G. rufa*, *L. barbulus*, *L. kersin* and *P. trutta* in the Greater Zab River

	C. macrostomus		***G. rufa***		***L. barbulus***		***L. kersin***		*P. trutta*	
	Reg.	R	Reg.	R	Reg.	r	Reg.	R	Reg.	r
SL	Y=1.126x+1.360	0.995	Y=1.294x-0.516	0.925	Y=1.133x+1.381	0.999	Y=1.155x+0.817	0.999	Y=1.171x+0.427	0.997
FL	Y=1.077x+0.721	0.994	Y=1.082x+0.251	0.997	Y=1.091x+0.545	0.999	Y=1.133x-0.288	0.999	Y=1.108x+0.225	0.998
HL	Y=4.486x+2.822	0.918	Y=2.142x+6.528	0.678	Y=4.297x+2.785	0.878	Y=4.947x-0.415	0.991	Y=6.631x-3.569	0.981
SnoL	Y=1.731x+1.299	0.886	Y=1.026x+0.930	0.729	Y=1.750x+1.815	0.828	Y=3.056x-0.837	0.954	Y=2.633x+0.930	0.898
ED	Y=2.75x+1.096	0.618	Y=4x+0.2	0.755	Y=11.53x-5.197	0.610	Y=17.25x-11.52	0.875	Y=5.664x-0.621	0.795
PDL	Y=3.004x+1.039	0.946	Y=1.950x+3.644	0.984	Y=2.330x+2.169	0.903	Y=2.371x+0.761	0.998	Y=2.580x+0.167	0.994
DFL	Y=3.649x+3.262	0.901	Y=5.357x+2.778	0.848	Y=10.28x-4.050	0.989	Y=7.961x+2.076	0.972	Y=4.804x+9.495	0.928
DFH.	Y=5.915x+1.593	0.721	Y=3.658x+4.694	0.923	Y=8.467x-13.33	0.974	Y=5.070x+1.920	0.879	Y=4.892x+1.271	0.933
A FH	Y=1.681x+13.21	0.221	Y=3.846x+5.292	0.880	Y=7.534x-2.028	0.983	Y=7.688x-2.269	0.958	Y=4.804x+9.495	0.879
AFL	Y=2.909x+12.24	0.789	Y=10.94x+1.524	0.954	Y=11.69x+6.414	0.766	Y=8.298x+12.18	0.637	Y=11.48x+6.696	0.945
PCFH	Y=6.456x+0.352	0.942	Y=4.241x+2.324	0.966	Y=6.563x-0.164	0.991	Y=5.941x+3.094	0.987	Y=7.165x+0.292	0.993
PFH	Y=6.446x+1.452	0.974	Y=3.446x+4.412	0.866	Y=7.309x-0.678	0.993	Y=7.018x+0.693	0.994	Y=7.566x+1.648	0.985
CFL	Y=4.466x+3.607	0.731	Y=6.272x+1.109	0.880	Y=7.545x-5.468	0.963	Y=7.149x-3.986	0.983	Y=5.116x+3.206	0.903
CPD	Y=7.786x+6.410	0.858	Y=7.5x+3.1	0.898	Y=10.79x+0.377	0.987	Y=10.42x+1.216	0.998	Y=9.610x+3.110	0.970
MaxBD	Y=2.519x+6.268	0.867	Y=3.209x+5.125	0.771	Y=5.201x-0.464	0.978	Y=3.667x+5.947	0.996	Y=3.932x+3.092	0.962

Table 4. Meristic characteristics of cyprinid in the Greater Zab River/Qandil Village

	A.grypus	***C.damascina***	***C.umbla***	***C.kosswigi***	***C.luteus***	***C.kais***	***C.macrostomus***	***G.rufa***	***L.barbulus***	***L.kersin***	***P.trutta***
1	36-42	76-85	91-100	33-36	24-28	37-43	39-44	35-36	49-56	53-56	71-80
2	4-5	16-18	19-25	6	5	7-8	8	4	9-10	9-11	13-16
3	3	11-13	15-17	3-4	3	3-4	4	3	6-7	6	11-15
4	IV 8	IV 9	IV 9	IV 9-10	IV 10	IV13-14	IV 14-16	III 8	IV 8	IV 8	IV 8
5	III 5	III 5	III 5	III 6	III 6-7	II – III 7	II-III 7	II -III 5	III 5	III 5	III 5
6	15-17	15-17	14-17	15-16	14-16	12-13	10-13	13-14	16-18	16-17	14-18
7	8	8	8	8	8	8	7-8	7-8	8	8	7
8	19-22	23-25	17-20	11-14	12-16	14-15	17-21	21-24	18-22	17-19	25-29
9	2	1	1	2	1	1	1	2	2	2	1

The genus *Cyprinion* illustrates a relationship between total length and the measurements of different fish body parts. The maximum total length correlation of *C. kais* and *C. macrostomus* with standard length is r=0.990 and r=0.995, respectively. At the same time, the weakest correlation between total length and pelvic fin height (r=0.248) is observed in *C. kais*, while for *C. macrostomus*, it is identified with anal fin height (0.221).

The relationship coefficient 'r' connecting *G. rufa*'s total length and fork length was maximum at r=0.997 and minimum between complete length and noggin length at r=0.875, signifying a firm connection with total length.

Genus *Luciobarbus* has a significant correlation coefficient 'r' between total length and other morphometric parameters. The highest relationship between total length and standard (r=0.999) was observed in both species, *L. barbulus* and *L. kersin*. The lowest relationships were observed between total length and eye diameter (r=0.610) in *L. barbulus* and between total length and anal fin length (r=0.637) in *L. kersin*.

The relationship coefficient 'r' connecting *P. trutta's* total length and fork length was the highest at r=0.998 and the lowest between total length and anal fin height at r=0.879, signifying a strongly positive connection with total length. Morphometric analysis clarifies the correlation among body segments by employing the ratio of each segment to the total length for evaluation **(Ambily, 2017; Kamboj & Kamboj, 2019; Quvatov *et al.*, 2025)**.

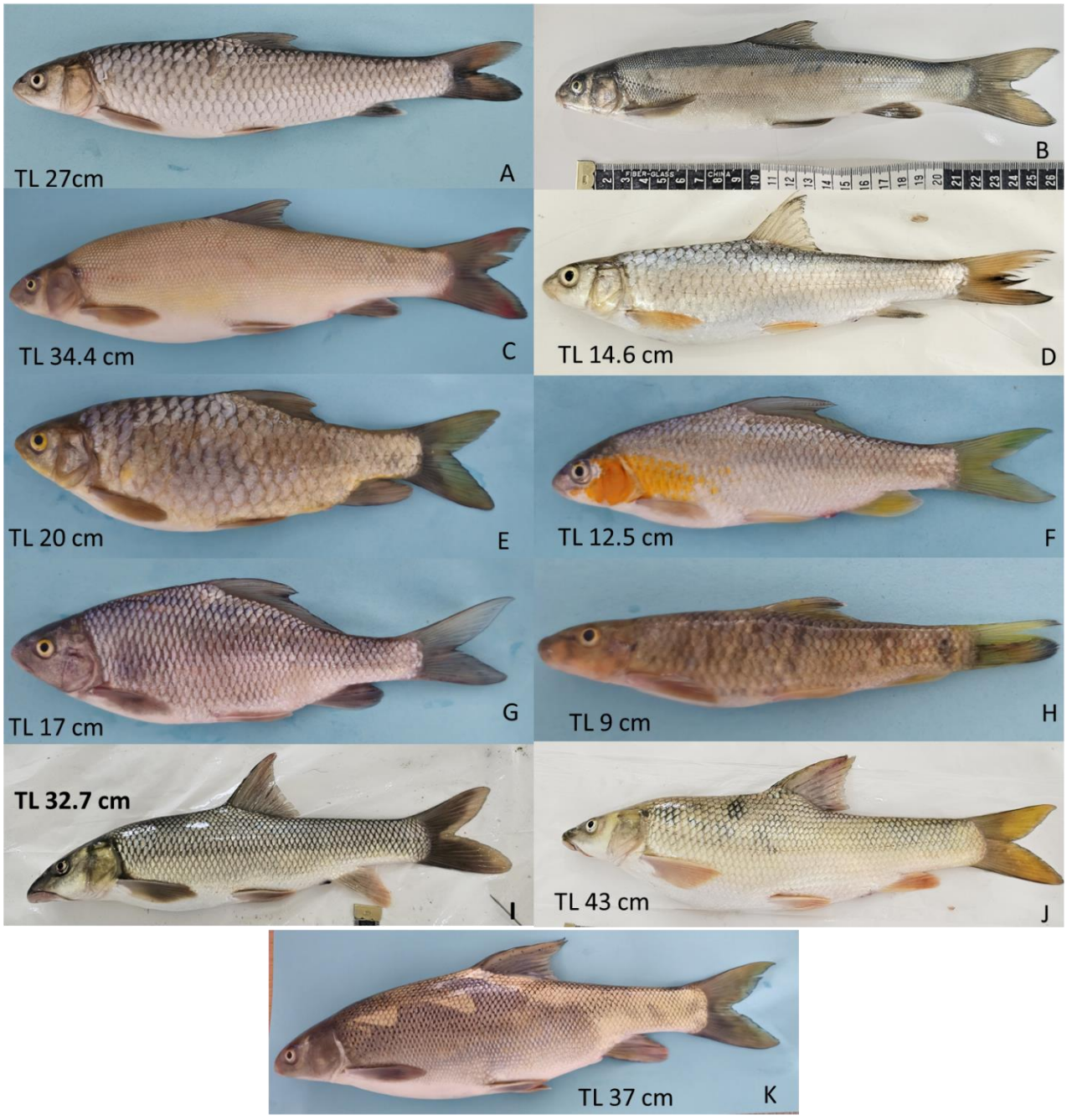

Fig. 2. Photograph of collected fish specimens: (A) *Arabibarbus grypus*, (B) *Capoeta damascina*, (C) *C. umbla*, (D) *Carasobarbus kosswigi*, (E) *C. luteus*, (F) *Cyprinion kais*, (G) *C. macrostomus*, (H) *Garra rufa*, (I) *Luciobarbus barbulus*, (J) *L. kersin* and (K) *Paracapoeta trutta*

DISCUSSION

The study investigates standard size metrics for eleven fish varieties, highlighting a significant relationship between morphometric characteristics and total body length, as proven by previous studies conducted in the Kurdistan Region and Iraq. A prior assessment conducted by **Namiq and Mahmood (2019**) revealed a significant interdependence between total length and various proportional variables of the morphology in *A. grypus* native to the natural waterways of Sulaimani. **Wahab (2013)** identified a significant relationship between total length and the correlations of various measurements across 12 species from the Cyprinidae, Luciscidae, and Mugilidae families found in the Tigris River near Salahal-Din City. **Shakir (2016)** documented a strong association between total length and various anatomical lengths of *Aspius vorax* (Heckel) inhabiting Tharthar Lake. **Hamad (2019)** discovered a correlation between the total length and body proportion ratio of some fish species, specifically within the Tigris/Saladin region. Notably, **Shaker (2023)** observed a striking correlation between total length and ratios of alterable measurements in two varieties, *C. luteus* and *Aspius vorax*, inhabiting the Tigris River close to the Al-Qalla area.

The analysis found a straight relationship between morphometric attributes and fish total length, consistent with earlier studies on diverse fish species and rivers, signifying a symmetrical increase in body metrics across differing length groups **(Johal *et al*., 2003; Naeem *et al*., 2012; Pant *et al*., 2018)**.

The findings are consistent with other investigations of morphological analysis of Cyprinidae species across various regions. **Dad *et al*. (2024)** in their study evaluated the morphometric parameters of Cyprinidae family in the Panjkara River, Pakistan, and reported a significant correlation between morphometric measurements and the total length of all species. **Shafi *et al*. (2018)** identified a notable correlation between total length and various morphometric parameters in specific Cyprinidae in Azad Jammu and Kashmir, Pakistan. A notable association between morphometric characteristics and total length was documented in *Hypophthalmichthys* sp. from the Pantnagar Farm in Uttarakhand **(Pant *et al*., 2018)**. **Paunikar and Kaneez (2023)** identified total length as the critical determinant for all morphometric parameters of *Amblypharyngodon mola*, a Cyprinid native to the Song River in Dehradun. Fish can rapidly change outward appearance in response to environmental fluctuations due to heightened sensitivity, allowing populations to adapt through morphological diversification. Considerable within-and between-population variations in form exist, boosting susceptibility to morphology-altering environmental influences (**Rehman *et al*., 2015**).

The data for nine meristic properties of cyprinids were documented. This involves measurements of lateral line scales, scales above and below the lateral line, dorsal and anal fin rays, pectoral and pelvic fin rays, gill rakers, and barbels. Table (4) displays the meristic counts for all fish species. Dissimilarities in meristic traits have traditionally been used to identify populations **(Anthony & Boyar, 1968; Namiq & Mahmood, 2019)**. Temperature increases and shifts in environmental parameters such as salinity and oxygenation primarily underlie meristic variation in fish **(Barlow, 1961)**.

The current research indicated that meristic counts were autonomous of body span, as they stayed nearly steady across all length groups of cyprinid species with fluctuating body lengths. Numerous reports have shown that the morphometric dimensions of fish species increase as their complete length increases, exhibiting a powerful positive relationship, and meristic counts were found to be uniform and not related to body size and length **(Saroniya *et al*., 2013; Kumaladewi *et al*., 2022; Paunikar & Kaneez, 2023; Shitole *et al*., 2024)**. The findings of meristic counts in the present analysis are evident in **Coad (2010)**, **Esmaeili *et al*. (2016)**, **Agha (2017)**, and **Nasri *et al*. (2018)**. Genetic factors may contribute to the noted disagreements. Restricted gene flow between populations inhabiting unique environments may result in genetic divergence, which could cause differences in meristic traits **(Reznick *et al*., 2001; Hendry *et al*., 2002)**. Furthermore, all-natural selection influencing genetic variation can propel the development of phenotypic features, like meristic qualities, in reaction to local environmental conditions **(Reznick *et al*., 2001)**. This current analysis is crucial for the future diversity of fish species.

CONCLUSION

The present analysis was conducted to provide a comprehensive report on cyprinid fish species from the Greater Zab River, Qandil Village in the Kurdistan Region. Eleven species from the Cyprinidae family were divided into three subfamilies. The differences in morphometric and meristic characters of the species were observed, which indicates that the developmental stage may have an impact on morphometric characters. These findings would help the fisheries biologists of the Region study their population parameters and implement suitable management strategies to ensure the sustainable utilization of these resources.

REFERENCES

Abdullah, S. M. A. (2002). Ecology, Taxonomy and Biology of some Parasites of Fishes from Lesser Zab and Greater Zab Rivers in North of Iraq. doctor Ph.D. Thesis (Ibn Al-Haitham), Univ. Baghdad: 153pp.

Agha, G. F. (2017). Morphological and Molecular Identification of Some Inhabitant Fishes in Greater Zab River/ Aski-Kalak in Kurdistan Region, Iraq. . M.Sc. Thesis, University of Salahaddin:118pp.

Agha, G. F.; Ibrahim, I. R. and Abdullah, S. M. A. (2021). DNA barcoding of the Cyprinidae from Greater Zab River_Gwer in Kurdistan Region, Iraq.Plant Arch , 21(2).:639-644

Agha, G. F.; Bilal, S. J. and Abdullah, S. M. A. (2023). DNA barcoding of some species of the genus *Capoeta* Valenciennes, 1842 from Kurdistan Region, Iraq. ZJPAS, 35(1):136-142.

Ali, M. K. and Abdullah, S. M. A. (2019). Morphological and molecular identification of *Capoeta trutta* (Cyprinidae) and *Planiliza abu* (Mugilidae) freshwater fish in Sulaimani Governorate, Iraq. Appl. ecol. environ. res, 17(4): 7439-7451.

Al-Muffti, N. S. A. and Abdullah, S. M. A. (2025). Length-Weight Relationship, Condition Factor, and Reproductive Biology of *Carasobarbus luteus* in Greater Zab and Lesser Zab Rivers in the Kurdistan RegionIraq. EJABF, 29(4): 1413-1427.

Ambily, V. (2017). Phenology and life history traits of *Arius subrostratus* (Valenciennes, 1840) from Cochin estuary, India. Changanacherry: . PhD Thesis in Zoology. N.S.S. Hindu College, 338pp.

Aminan, A. W.; Kit, L. L. W.; Hui, C. H. and Sulaiman, B. (2020). Morphometric analysis and genetic relationship of Rasbora spp. in Sarawak, Malaysia. TLSR, 31(2):33-49.

Anthony, V. C. and Boyar, H. C. (1968). Comparison of meristic characters of adult Atlantic herring from the Gulf of Maine and adjacent waters. Int. Comm. Northwest Atl. Fish. Res. Bull, 5: 91-98.

Barlow, G. W. (1961). Causes and significance of morphological variation in fishes. Syst. Zool., 10(3): 105-117.

Barriga-Sosa, D. L. A.; Nez-Badillo, M. D. L. J.; Iba´ n˜ ez, A.L. and Arredondo-Figueroa, J. L. (2004). *Variability of tilapias* (*Oreochromis* spp.) introduced in Mexico: morphometric, meristic and genetic characters. J. Appl. Ichthyol., 20(2004):7-14.

Bilal, S. J. and Nasraddin, M. O. (2025). Comparative monogenetic infections of some fish species in Greater and Lesser Zab rivers, Kurdistan Region, Iraq. ZJPAS, 37(2):1-10.

Çiçek, E.; Jawad, L.; Eagderi, S.; Esmaeili, H. R.; Mouludi-Saleh, A.; Sungur, S. and Fricke, R. (2023). Freshwater fishes of Iraq: A revised and updated annotated checklist. Zootaxa, 5357(1):1- 49.

Coad, B. W. (2010). Freshwater Fishes of Iraq. Sofia–Moscow, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario, Canada K1P 6P4.120pp.

Dad, O.; Khan, M. F.; Rasool, A.; Attaullah, M.; Israr, M.; Noreen, S.; Yousaf, N.; Khan, S. and Bano, A. (2024). Morphological study of fish species belonging to the family Cyprinidae in Panjkora river, Khyber Pakhtunkhwa, Pakistan. Zoo Botanica 02(2):1-3.

Dwivedi, A. K. and Dubey, V. K. (2013). Advancements in morphometric differentiation: A review on stock identification among fish populations. Rev. Fish Biol. Fish., 23(1):23-39.

Esmaeili, H. R.; Zareian, H.; Eagderi, S. and Alwan, N. (2016). Review on the taxonomy of Tigris scraper, Capoeta umbla (Heckel, 1843) and its confirmation record from the Iranian part of Tigris River, Persian Gulf basin (Teleostei: Cyprinidae). FishTaxa, 1(1):35-44.

Fricke, R.; Eschmeyer, W. N. and Fong, J. D. (2025). ESCHMEYER'S CATALOG OF FISHES: GENERA/SPECIES BY FAMILY/SUBFAMILY.

Hamad, A. S. A. (2019). Some biological aspects of fish in different areas of the Tigris River / Salah Al-Din Governorate / Iraq. PhD thesis, University of Tikrit.

Hendry, A. P.; Taylor, E. B. and Mcphail, J. D. (2002). Adaptive divergence and the balance between selection and gene flow: lake and stream stickleback in the Misty system. Evolution, 56(6):1199-1216.

Johal, M. S.; Negi, R. K. and Negi, T. (2003). Age and growth of golden mahseer Tor putitora from Pong reservoir, Himachal Pradesh, India. JEBS, 17(1):17-29.

Kamboj, N. and Kamboj, V. (2019). Morphometric and meristic study of four freshwater fish species of river Ganga. Indian j. anim. sci., 89(4):120-123.

Kumaladewi, P.; Mufasirin, Lastuti, N. D. R.; Alamsjah, M. A.; Darmanto, W. and Andriyono, S. (2022). Morphometric and meristic analysis of Rasbora in East Java Province. JAFH. 11(3),298-305.

Mizory, F. A. and Abdulrahman, N. M. (2019). Survey and ichthyofauna of Great Zab River in the Deralok hydropower plant. JUD, 22,(2):69-79.

Naeem, M., Zuberi, A., Khan, N. A., Rasool, S. A., Ismail, H. F. and Qamar, A. (2012). Some morphometric relationship traits of Labeo bata (Hamilton, 1822) from Head Panjnad, Pakistan. *Afr. J. Biotechnol*., 11(88): 15465-15468.

Namiq, K. and Mahmood, S. (2019). Morphometric, meristic and some blood parameters of Barbus grypus Shabout (Heckel 1843) in Sulaimani natural water resources, Iraq. Res. Agric., Livest. Fish, 6(1):153-162.

Nasri, M.; Eagderi, S.; Keivany, Y.; Farahmand, H.; Dorafshan, S. and Nezhadheydari, H. (2018). Morphological diversity of Cyprinion Heckel, 1843 species (Teleostei: Cyprinidae) in Iran. Iran. J. Ichthyol. 5(2):96-108.

Nelson, J. S.; Grande, T. C. and Wilson, M. V. H. (2016). Fishes of the World Fifth Edition.

Pant, B.; Kaur, R.; Lohani, V. and Ram, R. N. (2018). Morphometric characteristics (Hypophthalmichthy smolitrix) of silver under carp captive conditions. Pharma Innovation J., 7(2):17-20.

Paunikar, S. and Kaneez, F. (2023). Morphometric characters and meristic counts of two freshwater fishes of order Cypriniformes from Song River Dehradun, Uttarakhand. Int. J. Zool. Appl. Biosci., 8(6):1-6.

Pinheiro, A.; Teixeira, C. M.; Rego, A. L.; Marques, J. F. and Cabral, H. N. (2005). Genetic and morphological variation of Solea lascaris (Risso 1810) along the Portuguese Coast. Fish. Res., 73:6-17.

Quvatov Asqar Q.; Ubaydullayev O. Kh.; Almardanov J. B.; Narboev Z. U., and Rakhimova K. M. (2025). Comparative Morphometry of the Species *Schizothorax eurystomus* (Cypriniformes: Cyprinidae) Distributed in the Kashkadarya River Basin, Uzbekistan. EJABF, 29(3): 1773-1718.

Rehman, F. U.; Rehman, H. U.; Aman, S.; Aziz, S.; Shabir, H.; Majid, A.; Ullah, A.; Safi, A. U. R. and Subhan, F. (2015). Morphometric and Meristic Analysis of Silver Carp (Hypophthalmichthys molitrix) from Tanda Dam, District Kohat, Pakistan. Global Veterinaria, 15(1):82-92.

Reznick, D. N.; Butler, M. J. and Rodd, F. H. (2001). Life-history evolution in guppies Am. Nat.. VII. The comparative ecology of high- and low-predation environments. The American Naturalist, 157, 14.

Roy, P. R.; Lucky, N. S. and R., H. M. A. (2016). Morphological Characterization of Two Fresh Water Eels, *Monopterus cuchia* (Hamilton, 1822) and *Ophisternon bengalense* (McClelland, 1844). J. environ. sci. nat. resour. 9(1), , 9, 10.

Saroniya, R. K.; Saksena, D. N. and Nagpure, N. S. (2013). the Morphometric and Meristic Analysis of Some Puntius Species from Central India. Bio life, 1(3):144-154.

Sediq, O. S. and Abdulla, S. M. A. (2024). Assessment of fish structure community at Greater Zab River near Aski-Kalak city, Erbil. Iraqi J. Agric. Sci., 56(1):144-154.

Shafi, N.; Khan, Q. A. and Akhtar, T. (2018). Study of some morphometric characters of Cyprinidae family (Actinopterygii: Cypriniformes) of Azad Jammu and Kashmir, Pakistan. Int. J. Biol. Biotechnol., 15(2):315-323.

Shaker, H. F. (2023). Study of some morphological characters of *Barbus luteus* and *Aspius vorax* (Heckel) from the Tigris River near the Al-Qalaa area, Salah Al-Din, Iraq. CAES. , 5(1):231-237.

Shakir, H. (2016). Study of Some biological aspects of *Aspius vorax* (Heckel) in Tharthar Lake/Iraq. EJAS, 3(1):1-7.

Shitole, M.; Gadhave, M.; Jadhav, P.; Ghorpade, J. and Kare, S. (2024). Morphometric and meristic analysis of *Oreochromis mossambicus* from Nira River of Baramati tehsil of Maharashtra. Int. J. Entomol. Res., 9(5):64-67.

Snedecor, G. W. and Cochran, W. G. (1967). Statistical methods (6th ed.). , Ames, IA: Iowa State University Press.

Stiasny, M.L.J.; L.R., P. and Johnson, G.D. (1996). Interrelationship of Fishes, San Diego.

Strauss, R. E. and Bond, C. E. (1990). Taxonomic Methods: Morphology. In: Schreck, C. B. and Moyle, P. B. (eds). Methods for Fish Biology. American Fisheries Society, Maryland., 31.

Ujjania, N. C.; Kumar, G.; Langar, R. K. and Krishna, G. (2012). Biometric studies of Mahseer (Tor tor Ham. 1822) from BariTalab (Udaipur), India.Int. res. j. biol. sci., 2(3):138-141.

Wahab, N. K. (2013). Some phenotypic and biological aspects of a number of fishes of the Tigris River - Tikrit / Iraq. TJAS, 13(3):83-92.