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Systematics and Distribution of Freshwater Ichthyofauna in Babylon Province

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Abstract

Several studies have been carried out on the classification of freshwater fish (Ichthyofauna) in all of Iraq or in the Tigris and Euphrates basin. The current study consisted of (82 specimens) were collected from three different regions within Babylon Province for seven months. Taxonomic status of specimens was studied depending on morphometric traits (biometrics), then preserved in 70% ethyl alcohol. Surveyed area included three main sites in Babylon province, which is located in the center of Iraq. The diagnostic results showed that the collected fish samples related to five families, nine genera, and twelve species, as following: Family cyprinidae (*Aspius vorax*, *Barbus barbulus*, *B. luteus*, *B. xanthopterus*, *B. grypus*, *Carassius auratus*, *Cyprinus carpio*); family Bagridae (*Mystus pelusius*); family Siluridae (*Silurus triostegus*); family Mugilidae (*Planiliza*) (*Liza abu*) and (*L. subviridis*); family Cichlidae (*Tilapia zilli*).

Key words: Ichthyofauna, fresh water, Biometrics, Babylon, Iraq.

INTRODUCTION

In Iraq, the Tigris and Euphrates rivers are the main source of many water bodies, such as lakes, reservoirs, marshes and small rivers, where there are 58 species of freshwater fish (Coad, 1991), importance of fisheries in Iraq extends through history to about 4000 years when the Sumerians developed the oldest law of civil fishing (Al-Nasiri & Hoda, 1975). Fish meat is one of the most important sources of animal protein for humans, which characterized by its being an easy digestible food with high feeding standards compared to other animal protein sources (Bukhari, 1998). It also contains vitamins, oils and minerals, which play an important role in preventing many diseases such as pulmonary tuberculosis and weak liver function (Craig & Helfrich, 2012).

The study of the nature of the fish species and the environmental factors related to them is important in understanding the reality of the fish wealth and addressing the reasons that led to the lack of productivity, which are mostly due to overfishing, especially in times of reproduction, in addition to the illegal methods of fishing (AL-Rudainy *et al.*, 2008). Several studies have been carried out on the classification of freshwater fish in Iraq. These studies can be divided into two parts. The first section deals with the description, classification and listing of freshwater fish in all of Iraq or in the Tigris and Euphrates basin (Kalaf, 1961; Mahdi, 1962; Al-Hamed, 1966; Mahdi & Georg, 1969; Al-Nasiri & Hoda, 1970; AL-Daham, 1997; Banister, 1980; Al-Daham, 1982; Coad, 1996a, 1991, 2010). The second section concerned the classification of specific species of fish or species in specific areas of Iraq, including a study of Al-Nasiri & Hoda (1975) of the Shatt al-Arab fish in Basra and the study of Jawad (1975) for the phenotypic characteristics of three types of carotid family in the city of Basra as well as the study of Amari (2011) on the Hilla river and the



study of Amari *et al.* (2012) in the city of Hindiah. According to Coad (2010), about 80 species of fish belong to 26 families, of which about (27) species of marine fish related to 15 families are: Clupeidae, Engraulidae, Carcharhinidae, Ariidae, Hemiramphidae, Belonidae, Platycephalidae, Sillaginidae, Sparidae, Sciaenidae, Stromateidae, Scatophagidae, Soleidae, Mugilidae, Gobiidae.

53 species of freshwater fish related to 12 families: Cyprinidae, Siluridae, Bagridae, Cichlidae, Mugilidae, Cyprinodontidae, Heteropneustidae, Sisoridae, Cobitidae, Balitoridae, Mastacembelidae, Poeciliidae. These species are found in Iraqi inland water bodies and include rivers, lakes, reservoirs and marshes ranging from 1500 km² in seasons of low water level to 7,500 km² in flood seasons. More than 30 species of fish are economically important if they are desired by the local consumer and 12 species can be endangered. (AL-Rudainy *et al.*, 2008).

MATERIAL AND METHODS

Animals: The study consisted of (82 fish samples) were collected from three different regions within Babylon Province for seven months, from 2017 to 2018. Fish samples were collected from fishermen as well as caught directly. These samples then stored in crushed ice in an isolated box and transferred to the laboratory for studying phenotypic traits.

Chemical substances: Ethyl alcohol 70%, Formalin 10%.

Study Area: The Euphrates river is one of the longest rivers in Asia and covers a large area of about 35% of its total length of 2,800 km (UNISCO, 2002). The Euphrates river flows from the Euphrates River at the foot of the Indies while the Euphrates river runs southward through the city of Hindiayh (Tuareg district) of Karbala province. The water of the river is a warm and fresh water system and its salinity is increased southward and has a suitable base for the growth of aquatic organisms as well as its good ventilation (AL-Saadi *et al.*, 2000).

The surveyed area included the province of Babylon, which is located in the center of Iraq and is defined by geographic coordinates: 32° 5' 31.20"-33° 10' 2" N, 45° 12' 14.52' - 43° 55' E at 112 meters above surface the sea). The study included three main sites extending within the geographical coordinates: 32° 25' 46" N, 44° 13' 25" E - 32° 16' 15" N, 44° 25' 39" E (Table 1 & Fig. 1).

TABLE 1. Distribution of Fish Sampling by Collection Sites and Geographical Coordinates.

Area	Geographic coordinates		No. Samples (82)	Fish Species
	Latitude (N°)	Longitude (E°)		
Hilla district	32 ° 16 ' 59"	44 ° 25' 59"	21	<i>Barbus xanthopterus</i> , <i>B. grypus</i> , <i>B. barbulus</i> , <i>Tilapia zilli</i>
AL-Hashmiah district	32° 16' 15"	44° 22' 39"	27	<i>Barbus xanthopterus</i> , <i>Tilapia zilli</i> , <i>Liza abu</i> , <i>L. subviridis</i> , <i>Silurus triostegus</i> , <i>Mystus pelusius</i> , <i>Cyprinus carpio</i> , <i>Aspius vorax</i>
Hindiayh dam	32° 25' 46"	44° 25' 01"	34	<i>Barbus xanthopterus</i> , <i>B. grypus</i> , <i>B. barbulus</i> , <i>Tilapia zilli</i> , <i>Liza abu</i> , <i>L. subviridis</i> , <i>Silurus triostegus</i> , <i>Mystus pelusius</i> , <i>Carassius auratus</i> , <i>Cyprinus carpio</i> , <i>Aspius vorax</i> , <i>B. luteus</i>

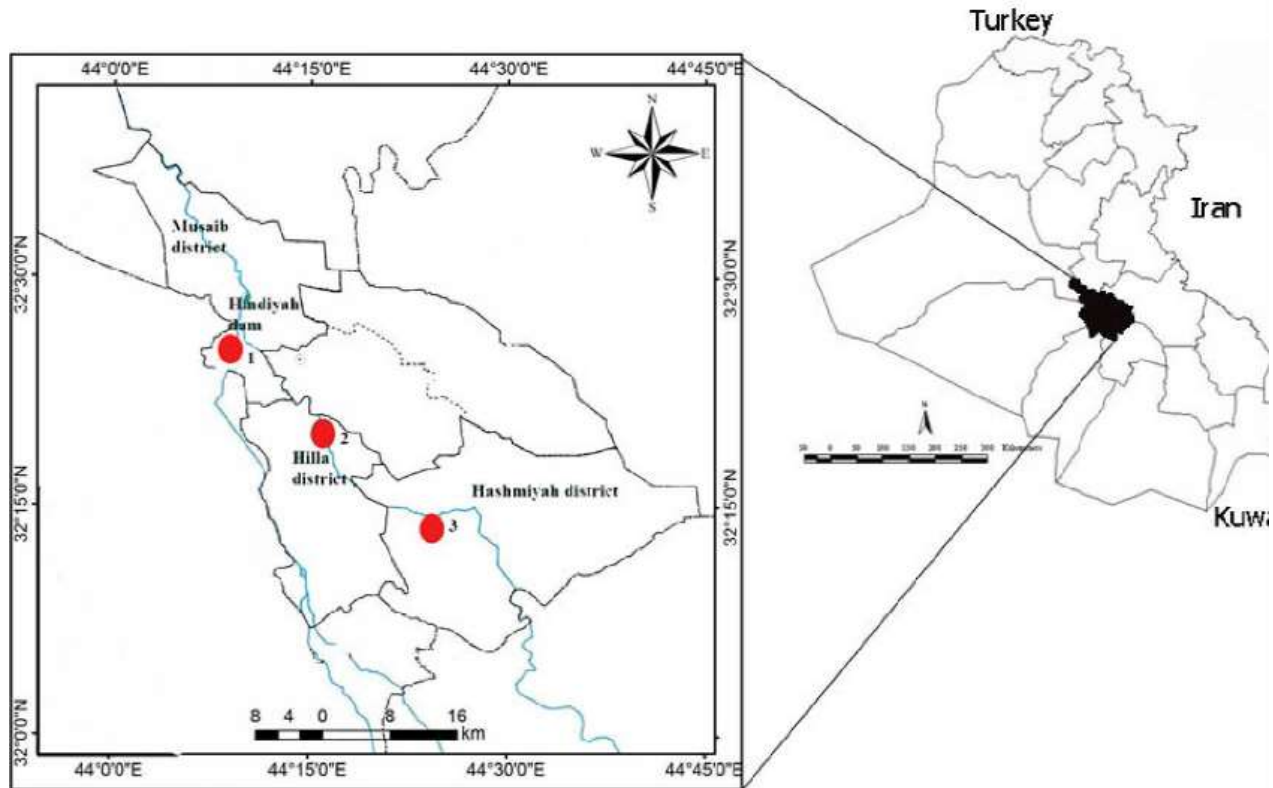


FIGURE 1. Map of Iraq and Babylon Province included the three surveyed sites from where fish specimens were collected (Red Circle): 1, Hindiayah dam; 2, Hilla district and 3, Hashmiyah district.

Tools: Digital camera, Digital caliper, Flexible tape, Balance, Waterproof paper, Sewing needle, Glass sheds, Photoshop software CS6 extended, Computer software "Statistical Package for Social Sciences" (SPSS) version 20 to analyze data statistically. Google earth was also used to determine geographic coordinates.

Study of Specimens: Fish samples were studied using dichotomous keys, the standard method for diagnosing animals in general. Coad (2010) was therefore used for identification collected fish species. Study taxonomic status of specimens depending on morphometric traits (biometrics) which studied at two levels.

Quantitative Characters: These include 18 metric characters (mm) and 2 numerical characters were studied as in table 2-A & B.

Qualitative Characters: All fish samples were examined for various phenotypic traits, including the presence or loss of certain structures.

Sample Preservation: Fish samples were fixed by injecting them with 96% ethyl alcohol or formalin 10%, then tagging and finally preserving in 70% or formalin 10% in suitable glass container, all specimens were kept in the fish laboratory in animal production department\ agriculture college\AL-Qasim Green university.

Statistical Analysis: SPSS statistical program were used for calculate mean, standard deviations and percentages of data.

TABLE 2-A. Quantitative (Meristic) Characters of Fish Samples.

Meristic Characters	Symbols
Dorsal fin number	DF No.
1 Dorsal fin spine number	FDF No.
1 Dorsal fin soft rays number	1DFR No.
Dorsal fin spine number	2DFS No.
2 Dorsal fin soft rays number	2DFR No.
Caudal fin spine number	CFS No.
Caudal fin soft rays number	CFR No.
Pectoral fin spine number	PFS No.
Pectoral fin soft rays number	PFR No.
Pelvic fin spine number	PFS No.
Pelvic fin soft rays number	PFR No.
Scales above lateral line number	SaLL No.
Scales below lateral line number	SbLL No.
Scales rows above lateral line number	SRaLL No.
Scales rows below lateral line number	SRbLL No.
Scales around caudal peduncle number	SCP No.
Barbels	B No.

TABLE 2-B. Quantitative (Metric/mm) Characters of Fish Samples.

Metric Characters	Symbols
Total length	TL
Standard length	SL
Fork length	FL
Head length	HL
Head depth	HD
Body wide	BW
Snout Length	SnL
Eye diameter	ED
Interorbital distance	IOD
Preorbital length	ProL
Postorbital length	PosL
Upper jaw length	UJL
Lower jaw length	LJL
Pectoral fin length	PFL
1Dorsal fin length	1DFL
2 Dorsal fin length	2DFL
Pelvic fin length	PVFL
Anal fin length	AFL
Caudal peduncle length	CPL
Caudal peduncle depth	CPD

RESULTS

A total of (82) fish samples were randomly collected from the Hilla river in the three locations within Babylon Province, based on diagnostic dichotomous keys. The results showed that the collected fish samples related to five families, eight genera, and twelve species (Al-Faisal, 2010; Coad, 2010; Al-Rudainy *et al.*, 2008), they are as follow:

Family Cyprinidae: The cyprinid family is the most speciose in Iraqi fresh waters. A total of 54 fish samples were collected, representing about 50% of the total fish harvested (Fig. 2). According to Coad (2010), this family consists of small (1 cm) and very large fish (3 m) in Iraq, characterized by the presence of pharyngeal teeth (1-3 row) on each side, a maximum of (8 teeth) per row, These teeth are distinctive for sex or type, there are no teeth in the jaws, the body shape varies from spherical to compact sides. The lips are usually thin and not sucker-like but can be very fleshy. Barbels are absent or present in 1-3 pairs (not more than 2 pairs in Iraqi species), body covered in cycloid scales, in some species easily lost, while the head is scaleless. It also has a single dorsal fin.

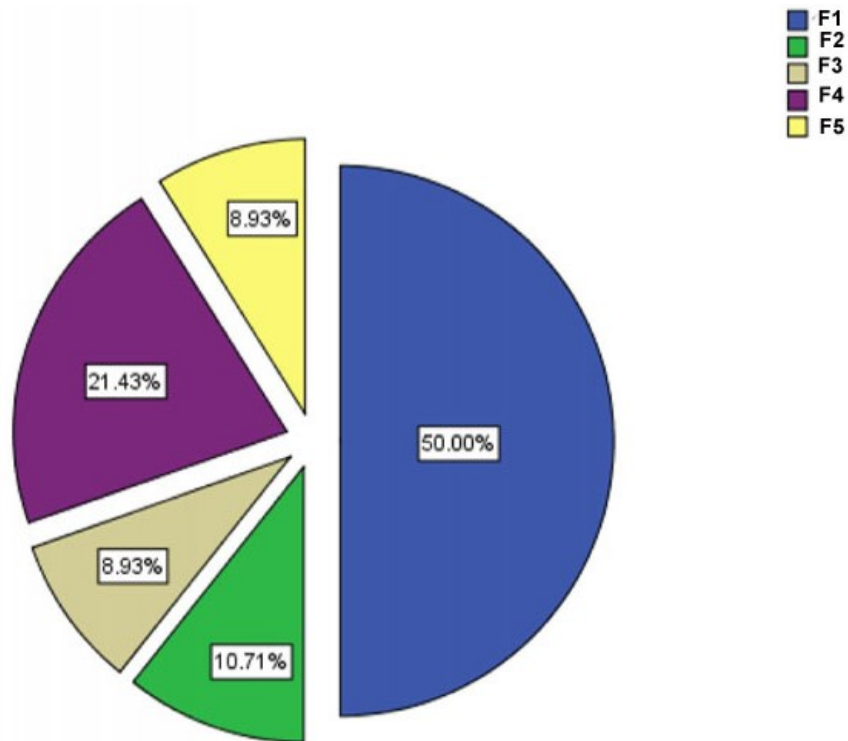


FIGURE 2. Percentages of families according of their numbers of specimens that collected from the study area, F1: Cyprinidae; F2: Mugilidae; F3: Siluridae; F4: Cichlidae; F5: Bagridae.

***Aspius vorax* Heckel, 1843**

Common names: Shilik.

Geographical distribution: Spread in most Iraqi water bodies in different ratios, dominant in Habbaniyah and Tharthar lakes and reducing in lake Haditha damlake and the main drain.

Diagnostic Features: Six specimens were collected. Body is elongated and compressed the mean of standard length (290 ± 60.8 mm), head is big with a mean of length (68.33 ± 23.63 mm) and depth (48.33 ± 10.4 mm), mouth is large and the cleft of the mouth is wide. Lower jaw (27.64 ± 6.69 mm) and is much projecting beyond the upper jaw (24.51 ± 8.26 mm) as in table 3. Scales are small, body color (uniform) silvery gray.

***Barbus barbulus* (Heckel, 1846)**

Common names: Al-Nabash or Abu-Baratum

Geographical distribution: spread in the central and northern regions of Tigris and Euphrates rivers, can also spread in Habbaniyah and Hamrin lake dam and the northern part of the main drain.

Diagnostic Features: Seven specimens were collected. Body is elongated with a mean of standard length ($340 \text{ mm} \pm 60.8$ mm). The mean length of the head is (50 ± 0.8 mm), mouth is inferior with two

pairs of barbels. Upper jaw is (15±0.88 mm) and the lower jaw is (20±0.79mm) (Table 3). Lip is broad and thick. Medium-sized scales. The color of the back and upper sides are brown. The color of the lower sides is lighter.

Feeding: Feeding mixed bottomless with the rule of animal components such as water insects, worms and mollusca, they prefer to live in the benthic areas of water.

***Barbus luteus* (Heckel, 1843)**

Common names: Himri

Geographical distribution: Can widely be found in Tigris and Euphrates rivers and their tributaries, and in all the Iraqi water bodies, dominant in the central, southern and western regions such as the marshes, Haditha dam lake and the main drain.

Diagnostic Features: Five specimens were collected. Mean of standard length of the body is (260±62.18 mm) and the head is small with mean length is (64.25±64.25 mm) and depth (50±11.55mm). Mouth small with a little extending, containing a pair of maxillary barbels, the upper jaw (21±2.7 mm) and the lower jaw (20.5±6.6 mm) (Table 3). Eyes and scales are rather large, body is brownish to reddish in dorsal with lighter sides and belly.

Feeding: The fish tend to live with the mid-column of water and move down to the bottom surface searching for food, omnivorous feeders, feeding mainly on aquatic plants and insects.

***Barbus xanthopterus* Heckel, 1843**

Common names: Gattan

Geographical distribution: Spread in Tigris and Euphrates rivers and their tributaries and all local lakes and reservoirs, reduced in number in local marshes and the southern regions of Iraq.

Diagnostic Features: Eight specimens were collected. Body shape is elongated and compressed, mean of standard length is (363.3±11.55 mm) and the head length is (88.33±7.6 mm) and depth (50±17.3mm). Mouth sub inferior, with two pairs of barbels which the inferior is slightly longer than the superior, lips are thick, eyes are small, scales are small, brownish on sides and belly is lighter. The upper jaw (22.13±18.5 mm) and the lower mandible (23.4±3.6 mm) as in table 3. Thick lips, small eyes, small scales, silvery body color, sides and abdominal area are lighter.

Feeding: Omnivorous feeders.

***Barbus grypus* Heckel, 1843**

Common names: Common Shabbout; shabbout; hamrawi. [large-scaled barb].

Geographical distribution: This species is found in the Tigris-Euphrates basin, the adjacent Gulf basins of Iran, and the Orontes (= Asi) River basin. In Iraq it is recorded from the Shatt al Arab river and its tributaries, the southern marshes, rivers such as the Tigris, Euphrates, Little Zab and Diyala, some smaller streams, lakes such as Habbaniyah, Tharthar and Razzazah, the Al Faw palace ponds at Baghdad, and reservoirs such as the Al-Hindiya dam, Al Qadisiyah dam reservoir on the Euphrates and the Dukan and Derbendikhan dams.

Diagnostic Features: Seven specimens were collected. Body is elongated and the mean of standard length (402.8±4.7 mm), Mean length of head (80.4±1.51 m). Mouth is moderate and inferior with two pairs of barbels, fleshy thick lips, upper jaw (78.8±0.8mm) which is larger than lower jaw (25±1.6 mm) as in table 3, eyes are small, and scales are rather small. Overall colour is a pale rose to orange, usually without other markings. The back is a dark olive-brown to blackish-green with the flanks yellowish to silvery and belly silvery to milk-white.

Feeding: This species is an herbivore taking filamentous algae and higher plant parts. Incidental food items taken while feeding on plants include fish tissue and scales. Fallen ripe fruits from trees overhanging the water are also consumed, as are cereal grains from loading docks. It may also take some small fishes. Other authors however consider this fish to be an omnivore in Al Qadisiyah Reservoir and Hammar Marsh consuming green and blue-green algae, molluscs.

Carassius auratus* (Linnaeus, 1758)*Common names:** Carp Thahabi**Geographical distribution:** Spread noticeably in all Iraqi water bodies and dominant in some of them in the last few years.**Diagnostic Features:** 14 specimens were collected. Body is broad with standard length (173.3 ± 109.7 mm), covered with large scales. Head length is (48.33 ± 16.07 mm) and depth (43.33 ± 23.04 mm), upper jaw length (1.9 ± 1.01 mm) and lower mandible (1.6 ± 1.15 mm). Number of scales on the lateral line (28-29 cm) as in table 3, with torsion in the dorsal fin. This species is very similar to *Cyprinus carpio*, except for barbels.**Feeding:** Herbivorous feeders with equal ratio of aquatic animals and plants components dominant of detritus in their diet.***Cyprinus carpio* (Linnaeus, 1758)****Common names:** Common carp**Geographical distribution:** Introduced to Iraq in the fifties as a breeder fish, then released into some local water bodies such as Habbaniyah lake and Darbandikhan dam lake and Abu-Dibs marsh and then spread in all Iraqi water bodies.**Characteristic traits:** Seven specimens were collected. Body is broad, with standard length (253 ± 83.88 mm), head length is (63 ± 9.45 mm) and depth (57.5 ± 17.08 mm). Mouth anterior is rather small that can extend with two pairs of barbels, scales are large, oliveceous with reddish upper parts, lower sides and belly are lighter, Upper jaw (13.22 ± 6.57 mm), lower jaw (20.32 ± 17.86 mm) (Table 3).**Feeding:** Omnivorous feeders, feeding mainly on mollusca, crustaceans and algae.**Family Bagridae:** This family is characterised by a scaleless body, a depressed head and rounded to compressed elongate body, short dorsal fin with a strong, often serrated spine, a strong, serrated spine in the pectoral fin, a short to long adipose fin, anal fin short to long, caudal fin forked or deeply emarginated, a free margin to the gill membranes over the isthmus, the anterior and posterior nostrils are well separated, anterior nostrils tubular, mouth ventral and transverse or arched, 4 pairs of barbels with the nostril barbel on the posterior nostril, maxillary barbels can be very long, other barbels are mandibular and mental (chin), teeth on the prevomer, premaxillaries and mandible, and eyes often covered by skin. These catfishes are generally nocturnal. The bagrid catfishes are found in freshwaters of Africa and Asia. There are about 18 genera and about 170 species, only one species is known from Iraq.***Mystus pelusius* (Solander in Russell, 1794)****Common names:** Abu Zummair**Geographical distribution:** Spread in Tigris, Euphrates, Shatt al-Arab, the main drain rivers and Habbaniyah Lake and in a few numbers in Himrin, Haditha and Dokan dam lakes.**Diagnostic Features:** Five specimens were collected. Body is somewhat elongated and naked with standard length is (151 ± 8.216 mm). The head is compressed and broad with length (32.8 ± 3.8 mm) and depth (24.4 ± 0.5 mm). Snout is somewhat depressed. The mouth is transverse and large with spiny teeth and four pairs of barbels, which extended from the end of the adipose fin while nasal barbels are small. The upper jaw (7 ± 2.7 mm) is the longest of the lower jaw (6.6 ± 2.1 mm) as in table 3. The eyes are small, the color of the dorsal side is olive, and the abdominal area is.**Feeding:** It has no commercial value, which can be exploited as fish powder, animal feed, insect, larvae, fish residue and aquatic plants**Family Siluridae:** This family is characterized by a scaleless and elongate body, a moderately compressed head, a non-protractile mouth, teeth on the jaws and palate, 1-4 pairs of barbels (nasal

barbels usually absent; maxillary barbels 1-2 pairs, sometimes vestigial or absent), nostrils separate, anterior ones tubular, gill openings very wide, dorsal fin short and spineless (usually fewer than 7 rays and sometimes absent), anal fin very long (41 or more rays) and may be confluent with the caudal fin, adipose fin absent, pectoral fin with a spine, often serrated, and pelvic fins small to absent. The sheatfishes are found in Europe and Asia. There are about 11 genera and about 97 species with 1 reported from Iraq.

***Silurus triostegus* Heckel, 1843**

Common names: Asian Running

Geographical distribution: It spreads in all inland water bodies, especially in the central and southern regions such as the Tigris, Euphrates, Shatt al-Arab, lakes, reservoirs and moons, as well as in the Dokan dam lake.

Diagnostic Features: Five specimens were collected. Body is elongated with a mean of standard length (398 ± 177 mm), also it is compressed and naked. Head is compressed from the upper part with length approximately (330 ± 51.48 mm) and depth (84 ± 0.9 mm), the lower jaw (34.04 ± 16.69 mm) is longer than upper jaw which is (27.85 ± 17.25 mm) as in table 3. Cleft of mouth is broad and wide with small and numerous teeth two pairs of barbels, the maxillary barbels extend to the end, those of the mandible to the middle of the head, body color brown to dark greenish.

Feeding: Liable to spread within slow current water, carnivorous feeders, feeding on small fish fry, frogs fry, and aquatic insects.

Family Mugilidae: The mullets or grey mullets are found worldwide in temperate to tropical coastal waters readily entering estuaries and even resident in freshwaters, there is one endemic species in Iraq that is one of the real freshwater fish, as well as three marine species.

This family is characterized by a compressed to subcylindrical body with a somewhat flattened head, moderate sized scales which may be cycloid but are ctenoid in most adults and extend onto the top and sides of the head, faint or no lateral line along the flank but pits or grooves on scales contain the sense organs. A spiny and short first dorsal fin (4 spines), the second dorsal with 1 unbranched ray or spine and 5-10, usually 8, branched rays, anal fin with 2-3 spines and 5-12 branched rays, an abdominal pelvic fin with 1 spine and 5 soft rays, pelvic bones connected to the postcleithrum by a ligament, the mouth is transverse and small, teeth on jaws short, weak and flexible, the lower jaw may be toothless.

***Liza abu* (Heckle, 1843)**

The name (*Liza*) was changed to *Planiliza* (Muhammad *et al.*, 2016).

Common names: Khishni, Abu Khraiza

Geographical distribution: Spread in high densities in all Iraqi water bodies and in earthen ponds as foreign fishes.

Diagnostic Features: Eight specimens were collected. Body is elongated and compressed with mean of standard length (266.1 ± 45.98 mm). Heads is deep and wide with a length (46 ± 18.6 mm) and depth (77.13 ± 71.98 mm), upper part greyish, and lower part is silvery, the length of the upper jaw is (14.15 ± 7.17 mm) and the lower jaw is (11.82 ± 6.56 mm). Scales are small tough, with two dorsal fins (Table3).

Feeding: Feed on organic crumbs and vegetable nuts.

***Liza subviridis* (Valenciennes in Cuvier & Valenciennes, 1836)**

The name (*Liza*) was changed to *Planiliza* (Muhammad *et al.*, 2016).

Common names: Biah; maid; meid; biah akhter; beyah akhter.

Geographical Distribution: Found in the Persian Gulf and eastwards to India, China, northern Australia and Polynesia. Reported from the Shatt al Arab River and the Hammar Marsh. Found in a recent survey in the Main Outfall Drain at Suq-ash-Shuyukh.

Diagnostic Features: Four specimens were collected. The standard length of body is (149.8±4.5 mm). Head is wide and flattened with length (39.5±3.7mm) and depth (30±2.2mm). The lower lip has a weak to marked symphysial knob (authors differ) and both lips are thin. The upper jaw extends back on a level with the anterior nostril to the anterior eye rim with length (9.5±1.5mm) and has teeth are in several rows and lower jaw length is (13.7±1.0mm) as in table 3, with ciliiform teeth in one row. The preorbital bone is strongly notched anteriorly and only occupies three-quarters of the space between the eye and upper lip. Scales are regularly arranged and are dense on the second dorsal and anal fins. The second dorsal fin origin lies over the anterior half of the anal fin base. The pectoral axillary scale is rudimentary or absent.

The pectoral fin does not reach back on a level with the first dorsal fin origin. The body color is bluish gray and the belly is often silvery white with long gray lines.

Feeding: Food items are algae, diatoms and detritus extracted from ingested mud and sand. Higher plants and copepods are also part of the diet in Iraqi waters.

Family Cichlidae: Known as warm freshwater fish in central and south America, Africa, India, Syria and Palestine. Characterized with a highly compressed body, a large head, and a dashed side line.

***Tilapia zilli* (Gervais, 1848)**

Common names: Zelian tilapia

Geographical distribution: Introduced for fish farming from Egypt but did not apparently survive. A specimen was caught in the Khabour River, Syria that enters the Euphrates just north of the Iraq border, presumably a fish farm escapee, and redbelly tilapias are now established in the Syrian Euphrates. A recent report by Bashar Abdul Hosein Ellewi Alsa'adi (*in litt.*, 10 October 2006) of a cichlid at Al Musayyib on the Euphrates River in Iraq may well be this species as are fish taken in the Qarmat Ali River 10 km north of Basrah and found in local fish markets in October 2009 (N. R. Khamees, *in litt.*, 19 October 2009).

Diagnostic Features: Six specimens were collected. The mean of standard body length is (229.7±39.58mm) it is compressed from both sides and has long dorsal fins with a fork start, the head length is (70.33±13.37 mm) and with a depth (68.33±20.66mm). The upper jaw length is (25.9±17.16mm), while the length of lower jaw is (24.66±12.8mm) as in table 3, the color of the darkened fish ranging from bluish green to greenish yellow with dark black lines on both sides.

Feeding: It is used in biological control of aquatic plant problems and in the killing of female host mosquitoes that transmit malaria.

DISCUSSION

The results that obtained in this study indicate the prevalence and presence of species (*Aspius vorax*, *Barbus barbulus*, *B. luteus*, *B. xanthopterus*, *B. grypus*, *Carassius auratus*, *Carassius carassius*, *Cyprinus carpio*) belonging to the Carpathian family Cyprinidae, which constitute the majority (50.00%) in the number of fish in the Hilla river (Fig. 2), and in Iraqi fresh water. According to Al-Faisal (2010), AL-Rudainy *et al.* (2008) and Coad (2010), this family constitutes 72% compared to the rest of the families. Evidence from cytochrome *b* DNA studies on cyprinidae shows that the Middle East is an important interchange area for this freshwater ichthyofauna, rather than a centre of speciation (Coad, 2010). The freshwater fishes of Iran comprise 155 species in 24 families, the most diverse family being the Cyprinidae with 74 species. Nineteen families have 5 or fewer species. Endemics number 24 species although this is expected to increase as new species are described. More than two-thirds of the species are restricted to a single drainage basin out of 20 examined although two cyprinid species are reported from 10 or more basins. The Caspian and

TABLE 3. Biometry (Metric and Meristic) Characters of Fresh Water Fish of Babylon Province.

Species	Total Number of Samples (82)		Metric Characters																	Meristic Characters		
			TL	SL	FL	HL	HD	BW	ED	IOD	PROL	POOL	UJL	LJL	PFL	FDFL	PVFL	AFL	CPL	CPD	CPS No.	LLS No.
<i>Aspius vortex</i>	6	Mean	330.0	290.0	306.7	68.3	48.3	71.7	9.2	18.9	3320.9	126.7	24.5	27.6	49.7	52.9	38.3	28.9	51.7	99.3	30	29.2
		Std. Dev.	60.8	60.8	57.7	23.6	10.4	14.4	1.5	2.2	16.4	23.1	8.3	6.7	0.5	11.2	7.6	23.4	27.5	9.8	1.58	23.2
<i>Barbus barbulus</i>	7	Mean	280.0	340.0	260.0	50.0	30.0	100.0	9.8	1.5	30.0	110.0	15.0	20.0	50.0	34.3	30.5	40.5	25.0	64.0	17	10.8
		Std. Dev.	0.55	60.8	0.44	0.81	0.79	0.8	0.2	0.1	0.8	0.8	0.88	0.79	0.8	1.0	1.3	1.3	0.8	0.8	1.14	1.0
<i>Barbus grypus</i>	7	Mean	461.2	402.8	430.8	80.4	70.4	105.0	92.4	72.6	161.2	164.6	78.8	25.0	30.8	64.6	44.6	40.6	105.0	34.8	14	64.6
		Std. Dev.	0.8	4.7	0.8	1.51	1.14	1.6	1.4	1.1	2.8	1.1	0.8	1.6	1.6	2.3	1.9	1.1	1.9	1.3	0.88	1.1
<i>Barbus luteus</i>	5	Mean	305.0	260.0	277.5	64.3	50.0	106.3	20.2	25.2	34.3	45.3	21.0	20.5	51.8	49.8	38.8	33.0	49.0	24.5	12	29.0
		Std. Dev.	69.5	62.2	61.8	9.9	11.5	17.0	11.4	22.7	47.8	48.8	2.7	6.7	12.9	17.9	2.5	11.5	6.4	7.0	1.58	6.6
<i>Barbus xanthopterus</i>	8	Mean	416.3	363.3	386.7	88.3	50.0	114.0	10.3	35.6	83.0	51.7	22.1	234.0	66.7	64.2	56.4	50.4	67.5	56.0	22	50.0
		Std. Dev.	31.9	11.5	25.2	7.6	17.3	21.6	1.7	8.2	84.0	59.2	18.5	360.4	12.6	12.4	7.7	9.1	3.5	0.2	0.707	14.1
<i>Carassius auratus</i>	14	Mean	234.3	173.3	173.3	48.3	43.3	98.3	7.2	2.6	24.5	6.3	1.9	1.7	1.7	5.3	2.3	2.3	30.0	28.3	12	5.0
		Std. Dev.	25.0	109.7	119.3	16.1	23.1	16.1	10.6	0.5	39.4	3.8	1.0	1.2	0.5	3.2	2.3	0.4	14.1	0.6	0.83	5
<i>Cyprinus carpio</i>	7	Mean	266.3	253.0	248.0	63.0	57.5	59.8	7.2	16.7	30.3	35.3	13.2	20.3	28.0	22.8	21.2	21.1	40.8	38.5	14	30.0
		Std. Dev.	59.1	83.9	53.4	9.5	17.1	34.0	3.6	10.0	23.8	51.4	6.6	17.9	32.8	16.5	14.1	12.8	14.2	9.1	0.89	19.3
<i>Liza abu</i>	8	Mean	298.8	266.1	275.9	49.6	77.1	62.4	11.4	20.0	21.1	52.7	14.1	11.8	30.3	48.6	30.4	30.6	47.2	4.4	20	78.8
		Std. Dev.	67.3	46.0	54.6	12.7	72.0	20.3	4.2	17.3	17.0	35.7	7.2	6.6	17.9	50.3	15.6	11.3	12.7	12.4	0.92	98.3
<i>Liza subviridis</i>	4	Mean	181.3	149.8	159.3	39.5	30.0	44.0	7.6	15.4	6.6	49.5	9.5	13.7	25.0	29.5	30.5	29.0	23.9	20	22	19.5
		Std. Dev.	4.7	4.5	1.0	3.7	2.2	1.4	0.4	1.0	0.4	1.3	1.3	1.0	0.8	1.3	1.3	8.8	1.6	0.8	0.95	1.3
<i>Mysrus pelusius</i>	5	Mean	182.2	151.0	170.0	32.8	24.4	32.0	6.4	10.0	14.4	32.2	7.0	6.6	27.0	33.6	18.2	23.8	32.0	15	0	17.0
		Std. Dev.	9.9	8.2	0.0	3.8	0.5	2.7	0.5	0.0	0.5	7.1	2.7	2.2	2.7	0.5	1.6	1.1	2.7	0.07	0.0	2.7
<i>Silurus triostegus</i>	5	Mean	468.0	398.0	460.0	105.	84.0	83.4	16.0	54.3	46.6	78.0	34.0	27.8	33.4	20.9	66.7	93.3	39.7	23.94	0	44.6
		Std. Dev.	100.3	177.0	236.1	25.0	27.0	48.4	17.5	33.0	32.8	27.7	16.7	17.3	26.8	27.0	55.1	146.0	11.9	0.26	0.0	18.6
<i>Tilapia zilli</i>	6	Mean	262.2	229.7	244.7	70.3	68.3	89.2	13.0	36.7	26.3	35.5	25.9	24.7	57.6	51.7	37.4	48.6	36.2	44.0	19	39.6
		Std. Dev.	58.1	39.6	65.3	13.4	20.7	27.6	3.0	32.1	4.3	20.3	17.2	12.8	21.2	53.8	15.2	15.1	8.7	12.0	0.707	9.3

Tigris basins have the most species with 74 and 54 species respectively (Coad, 1998). Furthermore, five nominal species have been described in genus *Cyprinion* from western Syria/Tigris Euphrates drainage and western Iran (Banarescu & Herzig-Straschil, 1995). From these, *C. kais* (Heckel, 1843) shows a wide distribution in the Tigris and Euphrates Basins from Turkey, Iraq, Iran and Syria. It seems that streams locality groups are closer to each other than Tigris River locality groups which like flow regime, stream bed and water quality makes Tigris River locality group that is different (Nasri et al., 2013; Kuru et al., 2014).

Some species, such as the common carp, gold, and carp, are exotic foreign fish that entered Iraq unknowingly and without any prior study of economic feasibility and potential future impacts on the reality of the fisheries in Iraq and contributed to the extinction of some species (AL-Rudainy et al., 2008).

14 specimens of the species *Carassius auratus* were collected during the current study, and according to Coad (2010) genus *Carassius* Nilsson, 1832 (goldfishes) comprise 2-3 species found in Europe, northern Asia and the Far East, and one species is now common in Iraq and is probably *C. auratus*, (the goldfish of aquaria) which is the type locality is China and Japanese rivers. Iraqi "goldfish" are often identified in the literature as *C. carassius*.

The species *Carassius carassius* was not collected in the current study, although it mentioned in the study of AL-Rudainy et al (2008), and this result agreed with the studies of Faisal (2010) and Coad (2010) which they mentioned that the presence of this species in Iraqi freshwater is not proven.

According to AL-Rudainy et al (2008) *Carassius carassius* similar to *Carassius auratus* with some morphological differences in the number of scales on the lateral line (39-54) while in *C. auratus* are (28-29 cm), and the dorsal fin is slightly concave in *Carassius auratus* but it convex in *C. carassius* and the caudal fin is divided into two equal lobes (Homocercal) in *C. auratus*, while is crescent-like in *C. carassius*.

9 of collected specimens were of the species *Barbus grypus* which consider an important food fish, that comprising 23% of the total fish production in Iraq, and forming the most important commercial fish there (an economical species). It was ranked third in the inland wholesale trade of Iraq for the period 1967-1970. This fish had the ability to use any available food type. The forehead is more rounded than in type material of *kotschyi*, although *kotschyi* types are smaller than *grypus* types, which may account for this distinction. The median lobe of the lower lip is well-developed in some individuals (such specimens were described as *kotschyi* - this form is rare in Khuzestan and intermediates can be seen but not in others *grypus* (Coad & Najafpour, 1997). The median lobe may extend back almost as far as the level of the rear margin of the lower lip or be distinctive with free lateral and rear margins but only extend back one third of this distance. The much fleshier lip structure in *kotschyi* (the upper lip can be reflexed for example) may be a form of hypertrophy seen in other cyprinid fishes.

5 of the fish samples were identified as the deep-seated, *Mystus pelusius*, which belongs to the family of the fish of Bagridae, which accounted for (8.93%) as in figure 2, according to Coad (2010) this species appears to be relatively common, although not often caught in large numbers, is of no economic importance, and its conservation status has not been assessed.

5 samples that related to the family Siluridae which comprising about (8.93%) as in figure 2, according to Coad (2010) only one species (*Silurus triostegus*) which belongs to this family is found in Iraq although some specimens appear anomalous and resemble *S. glanis* Linnaeus, 1758 of European and the Black-Caspian seas basins. Isolated microsatellite loci in both *S. glanis* and *S. triostegus* show that the species diverged less than 20MYA and/or have high levels of genomic conservation; these require further study to determine their identity. Authors have considered that there were the two species in the Dukan and Derbendikhan dams and rare specimens from southern Iraq appear different from *S. triostegus* (observations of N. A. Hussain, 2005). It is not desirable by the local consumer but can be exploited In the production of fish powder and other

small-scale species that have no commercial value in fish canning industries (AL-Rudainy *et al.*, 2008). Coad (2010) notices that *Silurus* bears 4 barbels in some specimens as opposed to the usual 6 in *S. glanis* but there is evidence that the four-barbelled *Silurus* (sometimes placed in a distinct genus *Parasilurus* Bleeker, 1862, now synonymised with *Silurus*) have 6 barbels when young and one pair of mandibular barbels is reabsorbed. Specimens with one pair and with two pairs of mandibular barbels have been reported, also there was one report recorded 4 mandibular barbels (2 pairs) in 3 specimens, 3 barbels in 1 specimen and 1 pair in another specimen for Turkish Euphrates fish. All *S. glanis* in one study had 4 mandibular barbels (2 pairs) while in *S. triostegus* 11 fish had 4 mandibular barbels and 12 fish lacked the posterior mandibular pair. There was no apparent trend in barbel loss associated with increase in body size.

6 specimens of *Tilapia zilli* belongs to the family cichlidae, which accounted for the ratio (21.43%) as in (Fig. 2), and these results are consistent with what Al-Rudainy *et al.* (2008), Al-Faisal (2010) and Coad (2010) identified the presence of these species of freshwater fish in Iraq's inland waters. According to Coad (2010), the type of *Tilapia* fish or fish from the African freshwater was brought from Egypt, so it is an exotic fish on the rivers and water bodies of Iraq, as well as entering the Euphrates river across the northern border of Syria. Several of them were caught in Basra (N. R. Khamees, in litt., October 19, 2009), al-Masib in Babylon (in litt., 10 October 2006), Diwaniyah, Nasiriyah. Al-Sa'adi *et al.* (2012) reported on the occurrence of cichlid fish *Tilapia zillii* (Gervais, 1848) in the Euphrates River at Al-Musaib City, Babylon province, since 2006. The United States Agency for International Development (USAID) has recommended *Tilapia* farming in Iraq although the cost would have to be a 20% premium over grass carp. A cheaper system would involve ponds in the southern marshes but in either case, the dangers of tilapia becoming established in the wild were not analyzed. (Coad, 2010) due to the rapid and easy growth and reproduction (Samaradivakara *et al.*, 2012). Also *T. zillii* has many attributes that make it suitable for culture. Among these are its general hardiness, high tolerance to adverse environmental conditions and overcrowding, its ability to withstand low oxygen and a wide range of salinity concentrations and resistance to diseases. *Tilapia* is able to survive and grow on a wide range of natural and artificial feeds, converts food efficiently, grows relatively fast, has a high yield potential and is accepted by a wide range of consumers. Furthermore, tilapia can be grown in a variety of culture systems ranging from simple systems with little infrastructure to more intensive and complex systems (Omotayo, 2015). The two species: Abu Khraiza (*Liza*) *Planiliza abu* and (*L.*) *P. subviridis*, which belong to the family of Albayih Mugilidae (Fig. 2), which accounted for the proportion (10.71%), by reviewing the statistical analysis of the data included in the present study, this may be due to the spread of these species in Iraq's inland waters in general and in the Hilla river in particular this is best illustrated by the relative abundance of each species. The rest of the species range in sovereignty and abundance, where the fork or *Tilapia* comes second and then the Asian run. This species is more sensitive to pollution than other Iraqi species tested, namely *Barbus luteus*, *Cyprinus carpio*, *Carassius carassius* (*sic*, probably *C. auratus*). *L. abu* was also more sensitive to arsenic than these species and more sensitive than *Barbus sharpeyi*, *B. xanthopterus*, *B. grypus*. This mullet has also been used to assess the impact of gas oil from oil spills in the Shatt al Arab River on ionic regulation, on the chloride cells and on the gills. It was found to be sensitive to this form of pollution and suitable as an indicator species (Coad, 2010).

In the last category comes the species of green plains *P. subviridis*, where the lowest number sample (4 specimens), may be this is due to the nature of this type of life where saline or brackish water is favored which spreading in the southern regions of Iraq, especially in Basra, where this species lives in the sea, particularly in coastal waters, lagoons and estuaries, but regularly enters fresh water, being found in marshes, rivers and canals. This species is recorded as moving from fresh water to brackish regions to reproduce. It was found in oligohaline habitats such as Garma Creek from December to early March and adults migrated to the Zubayr Inlet in March and April to spawn. At a freshwater station on the Shatt al Basrah Canal with salinities up to 3.5‰, this species was found to be dominant, comprising 59.6% by number and 40.0% by weight (Coad, 2010).

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LITERATURE CITED

Al-Daham, N.K., 1984. The ichthyofauna of Iraq and Arabic Gulf. Part III. Al-Basra University Press. 358pp.

Al-Daham, N.K., 1982. The ichthyofauna of Iraq. A checklist Basrah. 120 pp. Cited by: AL- Amari, M.J.Y.; AL-Taeem, M.S.M. and AL-Sultani, Dh.A.A. (2012). Journal of Babylon University Pure and Applied Sciences 20(5), 1522-1535.

Al-Faisal, A.J., 2010. Check of the taxonomy of freshwater fishes of Iraq. Iraqi Journal of Aquaculture 7(2), 101-114.

Al-Nasiri, S.K., Hoda, S.M.S., 1976. A guide to the freshwater fishes of Iraq. Basrah Natural History Museum Publication, 1: xii +124 pp.

AL-Rudainy, A.J., Rida, N.M., Hani, S.A., 2008. Atlas of Iraqi fresh water fishes. Republic of Iraq Ministry of Environment 52 pp.

Al-Sa'adi, B.A., Mhaisen, F.T., Al-Rubae, A.L., 2012. The First Parasitological Report in the Redbelly Tilapia *Tilapia Zillii* (Gervais, 1848) in Iraq. Proceedings of the Scientific Symposium of Natural History Research Center and Museum, University Baghdad, Baghdad, 1-7.

Al-Saadi, H.A., AL-Lami, A.A., Waqar, T.A., 2000. Environmental Factors and Their Relationship Fish Farming in the Qadisiyah Dam Lake. Journal of the Faculty of Education for Girls 11(2), 35-45 (In Arabic).

Banarescu, P.M., Herzig-Straschil, B., 1995. A Revision of The Species of The *Cyprinion macrostomus*-Group (Pisces: Cyprinidae). Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie 97, 411-420.

Banister, K.E., 1980. The fishes of the Tigris and Euphrates rivers, pp. 95-108. In: Rzóska, J. Euphrates and Tigris, Mesopotamian ecology and destiny. Monographiae Biologicae 38, x + 122 pp.

Coad, B.W., 2010. Freshwater Fishes of Iraq. Pensoft. Sofia-Moscow. PP 295.

Coad, B.W., 1998. Systematics Biodiversity in the Freshwater Fishes of Iran. Italian Journal of Zoology 65(S1), 101-108.

Coad, B.W., 1996a. Zoogeographic of the fishes of the Tigris- Euphrates basin. Zoology in Middle East 13, 51-70.

Coad, B.W., 1991. Fishes of the Tigris-Euphrates Basin. A critical List. Syllogeus No.68.31 pp.

Coad, B.W., Najafpour, N., 1997. *Barbus sublimus*, a new species of cyprinid fish from Khuzestan Province, Iran. *Ichthyological Exploration of Freshwaters* 7, 273-278.

Craig, S., Helfrich, A., 2012. *Understanding fish nutrition, feeds, and feeding*. Virginia polytechnic institute and state university.

Jawad, L.A.J., 1975. Biometric studies on three *Barbus* species from Basrah waters, Basrah, Iraq. *The Arab Gulf, University of Basrah*, 3, 212-247.

Khalaf, K.T., 1961. *The marine and freshwater fishes of Iraq*. Ar- Rabitta Press, Baghdad. 164 pp.

Mustafa, K.U.R.U., YERLİ, S., MANGIT, F., Erhan, Ü.N.L.Ü., Ahmet, A.L.P., 2014. Fish biodiversity in inland waters of Turkey. *Journal of Academic Documents for Fisheries and Aquaculture* 1(3), 93-120.

Mahdi, N., 1962. *Fishes of Iraq*. Ministry of Education, Baghdad, 82 pp.

Mahdi, N., Georg, P.V., 1969. *A systematic list of the vertebrates of Iraq*. Iraq Natural History Museum Publication, Baghdad 26, 1-104.

Nasri, M., Keivany, Y., Dorafshan, S., 2013. Comparative osteology of lotaks, *Cyprinion kais* and *C. macrostomum* (Cypriniformes, Cyprinidae), from Godarkhosh River, western Iran. *Journal of Ichthyology* 53(6), 455-463.

Omotayo, F., 2015. Morphometric characteristics and meristic traits of *Tilapia Zillii* from three major dams of a southwestern state, Nigeria. *Continental Journal of Biological Sciences* 8(1), 1 – 7.

Samaradivakara, S.P., Hirimuthugoda, N.Y., Gunawardana, R.H., 2012. Morphological Variation of Four *Tilapia* Populations in Selected Reservoirs in Sri Lanka. *Tropical Agricultural Research* 23(2), 105 – 116.

Unesco, 2002. *The challenge of achieving gender parity in basic education: a statistical review, 1990-1998*. Unesco.