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Assessment of Freshwater Fish Condition and Quality in Hor Abu Zarik Marsh during 2021–2022

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Abstract | This study investigated four species of Iraqi freshwater fish collected from two locations in Hor Abu Zarik, situated west of the central marshes near the end of the Euphrates River in southern Iraq. The investigated species included three members of the order Cypriniformes-*Barbus luteus*, *Barbus sharpeyi* and *Cyprinus carpio* (common carp)- and one species of the order Perciformes, *Liza abu*. A total of 520 fish specimens were collected between December 2021 and May 2022 from two sampling stations in Hor Abu Zarik. All sampling activities were conducted during daylight hours using a cast net, which is locally recognized as one of the smallest traditional fishing nets. Morphometric measurements of the sampled fish were recorded and both condition factor and feeding intensity were evaluated. The results demonstrated that *Barbus luteus* and *Barbus sharpeyi* collected from the second sampling station exhibited the highest condition factor values among all studied fish species, reaching 2.27 and 2.03, respectively. In contrast, the condition factor values of *Liza abu* from both stations were relatively similar. Likewise, the condition factor values of *Cyprinus carpio* showed only slight variation between the two stations. Regarding morphometric characteristics, *Barbus sharpeyi* specimens collected from the second station exhibited greater body length and weight compared to those collected from the first station, whereas *Liza abu* specimens showed relatively similar length and weight measurements at both sampling locations.

Key Words Fish, Marsh, Abu Zark, Freshwater, Quality

INTRODUCTION

Fish represent one of the most important aquatic resources and are considered renewable natural resources capable of replenishing themselves annually.

The marshlands serve as important breeding grounds for numerous marine, freshwater fish species and shrimp. The marshes of Iraq have been recognized as an exceptional global natural heritage site. The World Wide Fund for Nature (WWF) classified the Iraqi marshes among the world's one hundred exceptional ecological regions that should be protected as natural reserves [1].

Since ancient times, humans have utilized these aquatic resources through fishing activities. Over time, fishing practices and equipment have undergone substantial development as fishing areas expanded. Fishing has evolved from a subsistence activity into an important economic sector supplying raw materials for feed production, pharmaceutical industries, chemical industries and food processing industries, in addition to meeting daily nutritional needs.

Fish resources have attracted increasing attention from researchers with the aim of improving and preserving their productivity to meet the growing demand for white meat associated with continuous population growth and the persistent shortage of animal protein sources. Consequently, global attention has shifted toward seas, oceans and aquatic ecosystems to increase food production, particularly fish, which are considered among the most economical and important sources of high-quality animal protein.

Statistical reports and scientific studies have demonstrated that fish protein constitutes a significant proportion of the total dietary protein consumed by humans.

The protein content in fish flesh ranges from approximately 20–90% of dry weight and about 8.5% of wet weight, exceeding the protein levels found in beef (16.8%), eggs (13.6%) and milk (3.8%). Fish protein possesses high nutritional value because it contains essential amino acids required for human nutrition. In addition, fish oil and liver are rich sources of vitamins A and D, as well as essential minerals such as calcium, phosphorus and iron (Arab Organization for Agricultural Development).

Carnivorous Fish (Carnivorous)
These are predatory fish species that feed primarily on animal matter. They possess specialized teeth adapted for biting, tearing, grasping, crushing, or holding prey. Carnivorous fish generally have a true stomach, while their intestines are relatively short, elastic and thick-walled.

Herbivorous Fish (Herbivorous)
These fish species typically lack true teeth but possess a highly developed system of gill rakers that enables them to filter and extract microscopic organisms from the water. Herbivorous fish are characterized by the absence of a true stomach and the presence of long, thin-walled intestines.

Omnivorous Fish (Omnivorous)
These fish possess digestive systems intermediate between carnivorous and herbivorous species. They feed on a wide variety of food materials, including aquatic plants, plankton, aquatic invertebrates and organic detritus of suitable size.

The importance of fish is not limited solely to their nutritional value; it also includes fish meal produced from fish residues. Fish meal is considered one of the richest sources of animal protein used in manufactured feed and in feeding cultured fish within artificial aquaculture systems [2]. In addition, fish and their non-edible parts are utilized in several important industries such as oil production, colloid extraction, gelatin manufacturing, canning, drying and other industrial applications.

Fish meal contains all essential amino acids required in fish nutrition, as well as unsaturated fatty acids that play an important role in feeding by serving as major energy sources and contributing to body formation and growth [3].

Several fish species inhabit the Iraqi marshlands, including:

- **Al-Kattan:** One of the largest and highest-quality fish species; large individuals are locally known as "Jassana"
- **Al-Bunni:** Considered among the finest fish species, characterized by its yellow coloration; smaller individuals are locally called "Adhlah"
- **Al-Jari:** A scaleless fish species
- **Al-Shallaj:** A predatory fish that feeds on smaller fish species; its consumption is generally undesirable among marsh inhabitants except during periods of fish scarcity
- **Al-Hamri:** A small reddish-colored fish species with limited commercial importance and low preference for consumption
- **Al-Zouri:** A small-sized fish species locally referred to as "Khashni"; it is inexpensive and often regarded as food for low-income families
- **Al-Sabour:** A marine fish species rarely found in the marshes
- **Abu Al-Zumair:** A fish species characterized by an unattractive appearance and long pointed barbels; its consumption is prohibited
- **Abu Al-Hukm:** A small poisonous fish introduced into Iraqi waters in 1959 to control snails responsible for bilharzia disease; it is not consumed and is locally called "Leader Fish"
- **Shrimp:** Small shrimp-like aquatic organisms resembling worms; marsh residents rarely catch them except when using specific fishing methods locally known as "Al-Zahr"
- **Caribbean Fish:** Locally referred to as "Samtiyah" because of its large size; introduced into Iraqi waters around 1980
- **Turtles:** Aquatic organisms, some locally known as "Al-Ghailam" or "Al-Rafsh," which are hunted for their fat, traditionally believed to have medicinal value for treating rheumatism

MATERIALS AND METHODS

A total of 520 fish specimens were collected during the study period extending from December 2021 to May 2022 from two different sampling stations in Hor Abu Zarik. All fishing operations were conducted during daylight hours.

Fish samples were collected using a cast net, locally known as "Al-Tarha," which is considered one of the smallest fishing nets commonly used in the region. The radius of the net ranged between 5-6 meters, while the mesh opening diameter was approximately 2.5 cm. At the center of the net, there is a circular opening with a diameter ranging from 15-20 cm attached to an iron ring through which a thick throwing rope passes, measuring approximately 5 meters in length. Lead sinkers attached around the edge of the net facilitate its spreading and sinking in the water.

The cast net is thrown into the water so that it spreads circularly over the water surface, covering the fish present in the targeted area. Upon pulling the rope, the net closes and forms a bag-like structure that traps the fish and prevents their escape. This type of fishing net is widely used in the marshes of southern Iraq, as well as in coastal regions, shallow lakes and rivers.

The present study investigated four fish species belonging to the class Osteichthyes (bony fishes), namely Barbus sharpeyi (Bunni), Barbus luteus (Hamri), Cyprinus carpio (common carp) and Liza abu (Khashni). These species were previously classified and described by several researchers, including Khalaf [4], Mahdi [5] and Beckman [6].

The complete taxonomic classification of the studied species is as follows:

- **Phylum:** Chordata
- **Subphylum:** Vertebrata
- **Superclass:** Pisces
- **Class:** Osteichthyes

Order: Cypriniformes

- **Suborder:** Cyprinoidei
- **Family:** Cyprinidae
- **Subfamily:** Cyprininae
- **Genus:** Cyprinus
- **Species:** Cyprinus carpio (Common Carp)

Subfamily: Barbinae

- **Genus:** Barbus
- **Species:** Barbus sharpeyi and Barbus luteus

The taxonomic classification of Liza abu (Khashni fish) is as follows:

Order: Perciformes

- **Suborder:** Mugiloidei
- **Family:** Mugilidae
- **Genus:** Liza
- **Species:** Liza abu

Barbus Sharpeyi (Gunther)

Barbus sharpeyi (Bunni fish) is characterized by a light coloration on the ventral side and a dark green coloration on the dorsal side of the body. The total body length is approximately five times the head length and about four times the body depth. The number of scales along the lateral line ranges between 30 and 31 scales and the head lacks barbels. The caudal fin is deeply forked.

This species can attain a total length of approximately 60 cm. Spawning activity occurs mainly during the months of March and May. Barbus sharpeyi is considered a herbivorous fish species and possesses a non-true stomach.

The species is widely distributed throughout Iraq, particularly in the southern and central regions, as well as in the Tigris River near Balad, the waters of the Shatt al-Arab and the Euphrates River near Ramadi. However, the highest abundance of this species has been reported in the Hindiya Barrage region [5,6].

Barbus Luteus (Heckel, 1843)-Hamri Fish

Barbus luteus is one of the widely distributed freshwater fish species in the waters of Iraq. The ventral surface is characterized by a light yellowish coloration, whereas the dorsal surface appears dark brown. The head is relatively small and pointed anteriorly, containing a pair of short barbels located on the jawbone.

The standard length of the fish is approximately three times the body depth and about 4.5 times the head length, reaching a total length of nearly 30 cm. The fins are light gray in color and the dorsal body surface is more convex than the ventral surface. The dorsal fin contains three simple rays and ten to eleven branched rays. The third simple ray is ossified and hardened but lacks serrations. The origin of the dorsal fin is positioned opposite the beginning of the pelvic fin.

The body is covered with large scales, with the number of scales along the lateral line ranging between 28 and 30 scales. This species is widely distributed throughout various regions of Iraq, especially in the southern and central regions, including the waters of Balad, Sinjar, Baghdad, western Amarah, Basra and the Diyala River. It is less abundant in the outlets of Kurdistan waters and is also found in the Syrian territories [5].

A- Cyprinus Carpio (Linnaeus, 1758) – Common Carp

This fish species is characterized by a laterally compressed body with a flattened and rounded snout. The mouth is terminal and contains two pairs of barbels. The dorsal fin is very long and includes one hardened simple ray forming a spine. The origin of the dorsal fin lies opposite the origin of the pelvic fin.

The number of scales along the lateral line ranges between 35 and 38 scales extending through the middle of the body. The standard length is approximately 2.5 times the body depth and nearly three times the head length.

The common carp includes numerous subspecies with variable coloration. In natural environments, the dorsal region is typically dark silver, while body coloration may vary from reddish-orange to dark brown depending on the subspecies variation.

The original habitat of Cyprinus carpio is Asia. The species was introduced into Iraq during the 1950s from Netherlands in 1955 and from Indonesia in 1956. It was initially cultured at the Al-Zaafaraniya Fish Farm south of Baghdad and later released in 1958 into Lake Habbaniyah and the Tigris River.

D- Liza Abu (Heckel, 1843) – Khashni Fish

Liza abu is characterized by a gray coloration on the upper half of the body, while the ventral region appears silvery. The second dorsal fin and caudal fin are dark in color and the scale margins contain black spots. The species reaches a total length of approximately 26 cm. The ventral surface is more convex than the dorsal surface and the number of scales along the lateral line ranges between 28 and 30 scales. The caudal fin is slightly concave.

This species is widely distributed throughout Iraqi aquatic environments, particularly in the central and southern regions. It is also found in the Syrian basin, the waters of the Tigris River near Mosul, the Little Zab River and has also been recorded in the polluted waters of the Diyala River, as well as in the waters of Haditha Dam Lake, Lake Hamrin, Lake Habbaniyah and Al-Hammar Marsh.

Liza abu exhibits a broad environmental tolerance, enabling it to inhabit freshwater systems with varying salinity levels, including rivers, ponds, drainage canals such as Saqlawiyah Drain and the Main Outfall Drain. This species ranks first in terms of the number of fish captured in the southern Iraqi marshes [4,6,7,8].

Fish Measurements

Fish specimens were washed and excess moisture was removed using a suitable cloth. Fish lengths were measured individually using a fish measuring board and recorded in centimeters (cm). All body measurements were taken to the nearest 0.1 cm.

The following measurements were recorded for each fish specimen:

- **Total Length (TL):** Measured from the tip of the snout to the end of the caudal fin lobes
- **Standard Length (SL):** Measured from the tip of the snout to the base of the middle caudal fin ray (end of the urostyle bone)
- **Fork Length (FL):** Measured from the tip of the snout to the forked cartilaginous end of the middle caudal fin rays

The captured fish were also weighed individually to the nearest 0.1 g using a German-manufactured Sartorius balance.

CONCLUSION

Fish Measurements, Condition Factor and Feeding Intensity

The results obtained from fish length measurements, condition factor values and feeding intensity demonstrated that the condition of *Barbus luteus* and *Barbus sharpeyi* at the second sampling station was better than that observed at the first station. In contrast, the condition of *Liza abu* and *Cyprinus carpio* was relatively similar between the two stations, with no statistically significant differences observed.

When comparing fish body weights, *Barbus luteus* specimens from the second station were found to be heavier than those from the first station despite having similar body lengths. Furthermore, *Barbus sharpeyi* and *Cyprinus carpio* exhibited clear significant differences in both body length and weight. *Barbus sharpeyi* specimens from the second station were heavier and longer than those collected from the first station, whereas *Cyprinus carpio* specimens were heavier and longer at the first station compared to the second station.

In contrast, the body weights and lengths of *Liza abu* specimens from both stations were relatively similar, with no statistically significant differences detected.

The observed variations in fish length, weight and condition factor may be attributed to environmental and biological factors affecting fish populations, including water temperature, food availability, sexual maturity stages and sex [9,10,11].

The condition factor is considered an indicator of the health status, nutritional condition and fullness of the digestive tract of fish relative to the length–weight relationship within the same population [12]. Moreover, condition factor values may reflect the influence of stomach contents on fish body weight, as stomach contents may contribute up to 30% of total body weight [13]. Previous studies have also indicated that condition factor values increase with age and feeding intensity [14].

The present study further demonstrated that *Barbus sharpeyi* and *Cyprinus carpio* from the second station exhibited higher feeding intensity values compared with the remaining fish species studied at both stations. Feeding intensity in *Barbus luteus* from the first station was also higher than that observed in *Liza abu* from both stations.

Statistically significant differences in feeding intensity were observed between the two stations for *Barbus luteus*, *Barbus sharpeyi* and *Cyprinus carpio*, whereas no significant differences were detected for *Liza abu*.

Temperature plays an important role in increasing biological activity and accelerating food digestion processes, as previously reported by Lagler *et al*. [15] and Sarker [16], who noted that food consumption increases with rising temperature. Conversely, reduced feeding intensity may be associated with spawning activity during the reproductive season [17].

The findings of the current study are consistent with several previous local studies conducted in different regions of Iraq [18,19].

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