Some Biological and Morphological Aspects for Coptodon Zillii(Gervais, 1848) Inhabiting at Al-Tharthar Arm-Tigris River North of Baghdad, Iraq

Nehad K. Wahab
Animal Production Dep., College of Agriculture, University of Tikrit, Iraq.
Email: Nehadwahah@yahoo.com

Abstract
Some biological aspects and morphological for C. zillii inhabiting at Al-Tharthar Arm-Tigris River were studied during the period from April to September 2016. The growth pattern was positive allometric with (b) values for males 3.392, females 3.192, and for combined sexes 3.30. Condition factor values were lower than one and increased with size ranges between 1.265 and 1.984 with an average of 1.665 for combined sexes. Fish considered as herbivorous, six food items found in the diet, filament algae was the most important food item that occupied 57.84% of the diet, followed by plants particles’ and their seeds 27.08% and organic materials 12.38%. The percentage of food items by both methods differed between sexes. The research cover, the ratios of each of twenty morphometric measurements to total length, and each of four morphometric measurements to head length and their linear regression equations. All the length-length relationships between standard length and the others measurements were highly correlated.

Keywords: Biology, Morphology, C. zillii, Al-Tharthar Arm, Tigris River.

1. Introduction
Family Cichlidae reprehensive C. zillii and O. aureus are exotic fish to Iraqi aquatic ecosystems. No one how they introduced, maybe came from neighborly countries entered Euphrates River, centralized in main outfall drain and scattered in numerous inland water in Iraq. [1], recorded it for the first time during his study of the parasitic fauna of fishes from the Euphrates River in Al-Musaib City. Mutlak and Al-Faisal (2009) recorded two species of Cichlidae, C. zillii and O. aureus from the main outfall (Al-Dabab area) south of Iraq, and give classification key using morphological and meristic characters. C. zillii was the second prevailed fish community numerically contributing 22.72% in the Southern sector of the Euphrates River [2], while in Shatt Al-Arab it occupied 8.85% [3].

There are some published works on the biology of C. zillii in Iraq. [4], studied its condition factor from Tigris River in the Samarra region based on five specimens. [5], showed the specialization and diet overlap with Carassius auratus and Barbus luteus in East Al-Hammar Marsh. [6], studied some morphometric of gill raker for C. zillii from Shatt [7], referred to its reproductive biology in [8], found it omnivorous fish tend to plant materials. [9], studied some biological aspects of Tilapia Oreochromis aureus in the eastern drain in the Balad region.

The paper aims to provide data on length weight relationship, condition factor, stomach content, gonadosomatic index, and the morphology of C. zillii for the first time from the Al-Tharthar canal. This information will enhance the management, conservation, and culture of this species. It will also allow for future comparisons between populations of the same species.

2. Materials and Methods
Al-Tharthar canal conducts Tigris River with Al-Tharthar Lake to supply the Lake with water through Samarra dam (Fig1). The canal is distinction by the availability of the fishing activity. Most sources of fish captured in Samarra city comes from this canal. Sampling site covered around 17 Km from the beginning of the canal. Forty-nine specimens of C. zillii were caught twice a month during the periods from April to September 2016, using a seine net of 80 m. length and 8 m. height with a mesh size (30x30) and (40x40) mm. The total length ranged from 10.4-17.7 cm for females and 12.0-22.1 cm. for males. Estimation of length weight relationship done using the formula W = a L^b [10], which is transformed into logarithmic form Ln = Ln a + b (Ln L). Where W is the body weight in grams and L is the total length in cm and b regression coefficient of the relationship. Whose parameters fitted to a regression line by the least square method. The student’s t-test determined the significance level (P<0.05) of differences between isometric growth (b =3) and calculated b value in the equation. Condition
factor (K) computed using the formula: \( K = 100W/L^3 \) (Pauly, 1983). Sex ratios were compared to an expected 1:1 (male: female) distribution ratio using a \( \chi^2 \) test. Gonads removed and weighed (0.1 g) to estimate gonadosomatic index (GSI):

\[
GSI = \left[ \frac{\text{gonad weight}}{\text{total body weight}} \right] \times 100
\]

Specimens are preserved in the deep freezer immediately after measuring and weighing. The preserved fish were later dissected, the gut taken and food items from the stomach collected and analyzed. The percentage fullness of each stomach was assessed using the "point" method and the percentage frequency of occurrence method used [11]. Stomach contents were identified as far as possible under a binocular microscope. Morphometric measurements (Total length, Standard length, Dorsal fin base length, Body depth, Destine before dorsal fin, Head length, Length of pectoral fin, Length of dorsal fin, Head depth, Length of anal fin, Anal fin base length, Body width, Mouth length, Head width, Mouth width, Snout length, Tail length, Destine after dorsal fin, Pectoral fin base length and Pelvic fin base length) were taken. All measured to the nearest millimeter. The data were analyzed using simple linear regression of the morphometric measurements against fish total length. The equations expressing the length-to-length relationship derived by the method of least squares and the general form:

\[
Y = a + bX \quad \text{(Where } Y = \text{variable, } a = \text{Y intercept, } b = \text{regression coefficient and } X = \text{total length)}.
\]

Students’ t-test determined the significance level (P<0.05) of the differences between these variables.

3. Results

3.1. Size composition of the sample

Length distribution and length frequency of 62 individuals of C. zillii of total length ranging from 10.4-22.1 cm. and total weight from 19.00-196.81 gm. from Al-Tharthar canal carried out. As shown in Table 1, the greatest proportion of the sampled fish was 55.1% , for the length group 10.0-13.9 cm. TL followed 34.7 % for the length group14.0-17.9 cm., while the fish over 22.0 cm. was least represent in the sample.

| Total length groups(cm) | Number of fish | Proportion |
|-------------------------|----------------|------------|
| 10.0-13.9               | 27             | 55.1       |
| 14.0-17.9               | 17             | 34.7       |
| 18.0-21.9               | 4              | 8.2        |
| 22.0-25.9               | 1              | 2.0        |
| total                   | 49             | 100        |

Figure 1. Sampling area.
3.2. Length-weight relationship

Sampled *C. zillii* showed that they have positive isometric growth patterns. Regression coefficients inferred from the weight-length relationships for males or females were significantly different, regression coefficients for females (3.192), males (3.392), and combined sex (3.309) were significantly different from the hypothesized value 3 at a 5 percent level of significance. The coefficient of determination \((r)\) was very high for each sex group and pooled samples of fish as well (Table 2).

**Table 2.** Measurements and parameters of weight-length relationships for *C. zillii* females, males, and combined sex.

| Dependent variable | n  | Mean L | L range (cm) | Log a | b     | r    |
|-------------------|----|--------|--------------|-------|-------|------|
| Female            | 17 | 13.69  | 10.40-17.70  | -4.605| 3.192 | 0.976|
| Male              | 32 | 14.88  | 12.00-22.10  | -5.153| 3.392 | 0.985|
| combined sex      | 49 | 14.47  | 10.40-22.10  | -4.923| 3.309 | 0.983|

n, number of specimens; L, total length (cm); a, intercept of the relationship; b, regression coefficient; r, coefficient of determination,

3.3. Condition factor

The mean condition factor for *C. zillii* males was 1.668, females 1.660, combined sexes 1.665, length group less than 17 cm 1.663, and length group more than 17 cm 1.810. (Table 3). No significant differences between the condition factors of males and females. The general trend in the condition factors of *T. zilli* is that relatively recorded higher for higher lengths of fish.

**Table 3.** Condition factor for *C. zillii* females, males, combined sex and length groups.

| Dependent variable | Mean W | W range | Mean K | ±SD | K range |
|-------------------|--------|---------|--------|-----|---------|
| Female            | 46.27  | 19.00-101.72 | 1.660  | 0.183| 1.265-1.903|
| Male              | 61.51  | 23.19-196.81 | 1.668  | 0.178| 1.278-1.984|
| combined sex      | 56.22  | 19.00-196.81 | 1.665  | 0.178| 1.265-1.984|
| Length group less than 17 cm | 42.10  | 19.00-83.00 | 1.633  | 0.178| 1.265-1.903|
| Length group more than 17 cm | 118.9  | 92.45-196.81 | 1.810  | 0.086| 1.725-1.984|

W, body weight (g); K, condition factor; SD, standard deviation

3.4. Sex ratio

There were 32(65.3%) males and 17(34.7%) females. This gives a male/female ratio of 1:0.55 in favor of the males.

3.5. Gonadosomatic index (GSI)

The mean GSI during the captured months ranged from 0.30-4.55 for females and 0.11-0.42 for males. The maximum GSI for females was 4.55±3.17 in May and the minimum 0.30±0.18 in August, while for males 0.42±0.18 in May and August.

![Figure 2. Changes in the GSI of females and males during the study period.](image-url)
3.6. Food habit

Six food items (Filament algae, plants particles, and their seeds, organic materials, inorganic sediments, diatom, and fish eggs) (Table 4). However, these food items occurred in the diet of the fish with different average percentage frequencies. The most important food item was filament algae that occupied 57.84% of the diet, followed by plants particles and their seeds 27.08% and organic materials 12.38 %. C. zillii was herbivorous; foods of plant origin were made of filament algae, plants particles, and their seeds and diatom, which occupied 86.3 % of the diet. The percentage of the food items was 0.792 for standard length and the lowest was 0.040 for Pectoral fin base length. The other ratios were 0.432, 0.307, 0.278, 0.245, 0.214, 0.204, 0.201, 0.189, 0.149, 0.141, 0.117, 0.116, 0.111, 0.106, 0.090, 0.080.

Table 4. Food items identified in the stomach of C. zillii.

| Food items                     | Female (%) | Male (%) | Combined sexes | Length group less than17 cm (%) | Length group more than17 cm (%) |
|--------------------------------|------------|----------|----------------|--------------------------------|---------------------------------|
| Filament algae                 | 78.18      | 100.00   | 64.93          | 57.84                         | 58.05                           |
| Plants particles and their seeds| 11.82      | 50.00    | 35.27          | 75.00                         | 27.08                           |
| Organic materials              | 9.55       | 87.50    | 13.90          | 87.50                         | 11.50                           |
| Inorganic sediments            | 0.45       | 12.50    | 0.39           | 18.75                         | 0.41                            |
| Diatom                         | -----      | -----    | 0.59           | 12.50                         | 0.38                            |
| Fish eggs                      | -----      | -----    | 2.93           | 6.67                          | 1.90                            |

The ratios of several body proportions to total length of C. zillii were calculated (Table 5.). It found that the highest ratio was 0.792 for standard length and the lowest was 0.040 for Pectoral fin base length. The other ratios were 0.432, 0.307, 0.278, 0.245, 0.214, 0.204, 0.201, 0.189, 0.149, 0.141, 0.117, 0.116, 0.111, 0.106, 0.090, 0.080.

Table 5. Comparison of several body proportion of C. zillii.

| Morphometric measurement (MO) | Mean (mm) | Rang (mm) | Ratio (MO)/total length ±SD | Ratio rang |
|-------------------------------|-----------|-----------|-----------------------------|------------|
| Standard length               | 123.59    | 83.00-137.00 | 0.792 ±0.020 | 0.729-0.810 |
| Dorsal fin base length        | 69.31     | 42.00-94.38 | 0.432 ±0.017 | 0.404-0.465 |
| Body depth                    | 49.05     | 34.45-68.80 | 0.307 ±0.011 | 0.293-0.331 |
| Destine before dorsal fin     | 44.32     | 32.00-60.06 | 0.278 ±0.013 | 0.261-0.308 |
| Head length                   | 39.14     | 26.22-55.94 | 0.245 ±0.007 | 0.238-0.253 |
| Length of pectoral fin        | 34.22     | 22.00-48.62 | 0.214 ±0.013 | 0.191-0.237 |
| Length of pelvic fin          | 33.13     | 19.00-52.33 | 0.204 ±0.016 | 0.183-0.237 |
| Length of dorsal fin          | 32.99     | 15.00-53.61 | 0.201 ±0.028 | 0.144-0.243 |
| Head depth                    | 30.85     | 18.91-41.85 | 0.191 ±0.015 | 0.170-0.207 |
| Length of anal fin            | 30.70     | 15.00-43.00 | 0.189 ±0.022 | 0.144-0.227 |
| Anal fin base length          | 24.06     | 14.00-33.00 | 0.149 ±0.012 | 0.132-0.166 |
| Body width                    | 22.89     | 13.14-31.43 | 0.141 ±0.009 | 0.126-0.153 |
| Mouth length                  | 19.00     | 9.00-30.00  | 0.117 ±0.012 | 0.087-0.138 |
| Head width                    | 18.99     | 11.60-30.39 | 0.116 ±0.008 | 0.112-0.138 |
| Mouth width                   | 18.20     | 8.00-29.00  | 0.111 ±0.015 | 0.077-0.131 |
| Snout length                  | 17.14     | 10.22-25.38 | 0.106 ±0.004 | 0.100-0.110 |
| Tail length                   | 14.57     | 9.00-19.67  | 0.090 ±0.006 | 0.078-0.099 |
| Destine after dorsal fin      | 12.54     | 10.00-18.46 | 0.080 ±0.010 | 0.070-0.096 |
| Pectoral fin base length      | 7.34      | 5.00-11.22  | 0.046 ±0.004 | 0.040-0.051 |
| Pelvic fin base length        | 6.47      | 4.00-9.28   | 0.040 ±0.004 | 0.034-0.046 |

and 0.046 for Dorsal fin base length, Body depth, Destine before dorsal fin, Head length, Length of pectoral fin, Length of the pelvic fin, Length of the dorsal fin, Head width, Length of the anal fin, Anal fin base length, Body width, Mouth length, Head length, Mouth width, Snout length, Tail length, Destine after dorsal fin, and Pectoral fin base length respectively.

The morphometric regressions for the relationship between total length (X) and the variables studied (Y) (Table 6). For the relationship between head length(X) and the variables (snout length, head width, mouth width, and head depth) for C. zillii (Table 7).
Condition factor of both sexes. Condition factor (K) values of this species were 1.668±0.178 for males and (1.660±0.183) for females from Wasai reservoir in Kano, Niger State, Nigeria. In [20], reported that the total length for this species was 105-162 mm from the main outfall drain. [13], mentioned that the range of total length was 87-178 mm and weight 12.35-123.230 gm. in East Hammar. [14], reported that the total length for the fish was between 108-148 mm from Al-Delmj Marsh. The growth of C. zillii was allometric. The fish do not grow symmetrically [15], [16], reported a positive allometric growth pattern from the new Calabar River. [17], found C. zillii from the A tropical reservoir, southwest Nigeria has an allometric growth pattern high and positive. Several authors have reported allometric growth as exhibited negative allometric growth patterns for C. zillii from Wasai reservoir in Kano, Niger, and from lower Usama Reservoir Abuja, Nigeria [18,19].

The mean condition factor (K) values were greater than one, which was an indication that fish were doing well in the Al-Tharthar canal. It was evident the conformity and nearly similarity between condition factor of both sexes. Condition factor of C. zillii attended values of condition factor (1.668±0.178) for males and (1.660±0.183) for females. In Itapaji Dam, in Nigeria values of condition factor for this species were 1.63 for males and 1.75 for females [20]. It appears that the overall sex ratio M/F 1:0.55, in favor of the males agreed with the finding of some research carried out by authors from other localities in Lake Timsah in Egypt 1:0.9 [21-24], pointed out that in the African lakes, it is common in the cichlid populations that males dominate because they generally exhibited more than females. Gonadosomatic index revealed that the spawning season of C. zillii might be in May. [25], recorded that the GSI for females C. zillii ranged from 0.32 to 3.58 and for males ranged from 0.15 to 0.34 from Lake Zwai. Gonadosomatic index of females found remarkably higher in values over males. [26], reported that GSI female fish is usually higher than that of the male because of the weight of the ovaries. El-Sayed et al. found the spawning season of C. zillii lasted...
from June to September. With a peak in July from Abu Qir Bay in Egypt. The filament algae, plant particle, and their seeds are the most important food items for C. zillii, and it considers herbivorous.[27], reported C. zillii preference for algae and vegetative matter might be attributed to its ability to secrete mucus from the gills that trap plankton. The blue green algae and organic matter are the more important food in the diet of C. zillii [28], However, their ability to digest filamentous algae and aquatic macrophytes are through the mechanism of physical grinding of vegetative matter between the two pharyngeal plates of five teeth and acidic nature (pH less than two) of the stomach that raptures the cell walls of algae and bacteria.[29], found it omnivorous fish tend to plant materials, and organic matter was the first food item in the Euphrates River at the Hindeya barrier. Several authors also reported that C. zillii feeds essentially on plant materials that are consistent with the present observation. [30], found the plant material occupied 87% of the food eaten in East Hammar Marsh. [24], found C. zillii was herbivorous, the feeding mode was reflected obviously on gill arch length, gill raker number, length, and width, which was characterized by more numerous. [22], recorded that algae represented more than half of the gut content of Oreochromis aureus in the eastern drain in Balad. The presence of organic materials and inorganic sediments within few percentages in the guts of C. zillii was examined to confirm the reports that C. zillii seldom browses on bacteria-laden detritus [11,17], found that the percentages ratios for (Body depth, Destine before dorsal fin, Head length, Length of pectoral fine, Length of the pelvic fin, Length of the dorsal fin, Length of the anal fin, Head depth, Body width, Head width, Snout length, and Destine after dorsal fin) to standard length of C. zillii were (45.72, 34.56, 33.86, 27.70, 29.48, 55.80, 18.13, 28.61, 14.19, 18.79, 12.57, and 11.05)% respectively from main outfall drain (Al-Dabab area). The percentage ratios were (43.07, 33.64, 27.67, 29.37, 55.80, 17.45, 28.32, 18.90, and 18.75)% for (Body depth, Head length, Head length of pectoral fine, Length of pelvic fin, Length of dorsal fin, Length of anal fin, Head depth, Body width, and Head width) respectively from [22], [10], pointed that in the same species of fish from different locations, the ecological condition of the habits or variation in the physiology of animals, or both are responsible for the variations of length-weight relationship.

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