

Some Biological Aspects of the Himri Barbel, *Barbus luteus*, in the Intermediate Reaches of the Euphrates River

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Received: 02.11.2004

Abstract: Growth; length-weight, standard-, fork-, and total length relationships; age composition; sex ratios; age at first maturity; and fecundity of the himri, *Barbus luteus*, from different sites along the middle reaches of the Euphrates River were investigated. Von Bertalanffy's growth models were $L_t = 54.71 (1 - e^{-0.110(t+0.163)})$, $W_t = 1252.833 (1 - e^{-0.127(t+1.825)})^{2.454}$ in males, and $L_t = 56.93 (1 - e^{-0.105(t+0.377)})$, $W_t = 1395.363 (1 - e^{-0.107(t-1.81)})^{2.545}$ in females. Isometric growth was identified from length-weight relationships. Younger age groups dominated the catches, with identifiable ages ranged from II to VII years. Sexual ratios were unbiased and did not deviate from 1:1. Most fish reached sexual maturity within the second year of age.

Key Words: *Barbus luteus*, growth, fecundity, Euphrates River.

Introduction

The himri, *Barbus luteus* (Heckel), is a barbel endemic to the Mesopotamian rivers. Beckman (1962) also reported its presence in the Orontes River. It is also known as *Carasobarbus luteus* according to Karaman (1971) from the Euphrates in Turkey. In local catchments, the himri can form a high proportion. This fish is highly valued as it is in high demand as food. Few studies have been done on the biology of this species in the Iraqi (i.e. lower) part of Mesopotamia (Al-Jaferye et al., 1976; Bhatti and Al-Daham, 1978; Al-Daham and Bhatti, 1979; Barak and Mohammad, 1982; Jerzy and Ali, 1982; Ahmed, 1982; Ahmed et al., 1984; Naama and Muhsen, 1986; Epler et al., 1996; Szypula et al., 2001; Epler et al., 2001). No biological studies have been conducted in the Syrian (i.e. intermediate) or the Turkish (i.e. upper) reaches.

The Euphrates River can be divided into 3 reaches. The intermediate reach starts at the Syrian-Turkish border and ends about 200 km from the Syrian-Iraqi border with specific hydrobiological and limnological characteristics of biotic and abiotic factors. Along this reach, there is one dam lake in the Syrian section (Tabqa) and one barrage lake in the Iraqi section (Hindeiya).

These investigations are the first study from the intermediate reaches of the Euphrates River on himri

growth in terms of length and weight, length relations, age composition, sex ratio, age and length at first spawning, and fecundity and its relationships to growth characteristics.

Materials and Methods

Samples ($n = 186$) collected from 3 different sites along the study area (Figure 1) using gill nets (3 x 3, and 6 x 6 cm mesh size, 80 m net length). The Tabqa and Hindeiya reservoirs were not included in the investigations due to habitat differences. Samples were collected biweekly in March, May, June and October 2003 to investigate fecundity in pre-spawning, spawning and post-spawning seasons according to Al-Daham and Bhatti's (1979) classification of ovarian annual development. The total length (TL), standard length (SL) and fork length (FL) were measured to the nearest 0.1 cm and the total weight (W) recorded to the nearest 0.01 g. Growth rates in length and weight were calculated using von Bertalanffy's (1957) growth equation facilitated by the Ford-Walford method (Ford, 1933; Walford, 1946). The length-weight relationship was calculated using logarithmic transformed data of FL and W (Le Cren, 1951). Linear relationships between different lengths (SL, TL and FL) were estimated. Age was determined using scales under a binocular microscope



Figure 1. Sampling sites in the intermediate reaches of the Euphrates River.

with transmitted light. Sex was determined for most samples by examining gonad tissues either macroscopically or after dissection and examining tissues under a stereomicroscope for smaller individuals. The sex ratio was tested by the chi-square test to indicate whether there was a deviation from a 1:1 ratio.

Age at first sexual maturation was determined by observing the gonads in the samples of fish II and III years old ($n = 72$) in the pre-spawning and spawning season (March to June) and its developmental stages according to Bhatti and Al-Daham (1978) and Al-Daham and Bhatti (1979). Ovaries selected from 30 ripe females of the different age groups (5 from each group) were weighed to the nearest 0.01 g to calculate total fecundity using the gravimetric method (Libosvsky, 1979). Regressions between fecundity and standard length ($F = a L^b$), weight ($F = a W^b$) and age ($F = a T^b$) were calculated using logarithmic transformed data (Pitcher and Macdonald, 1973).

Results

The mean lengths and mean total weight in the different age classes of females and males are given in Table 1a,b. Age-length relationships (von Bertalanffy) calculated using mean fork lengths were $L_t = 54.71 (1 - e^{0.110(t+0.163)})$ in males and $L_t = 56.93 (1 - e^{0.105(t+0.377)})$ in

females. Modified von Bertalanffy equations for age-weight relationship were $W_t = 1252.833 (1 - e^{0.127(t+1.825)})^{2.454}$ in males and $W_t = 1395.363 (1 - e^{0.107(t-1.81)})^{2.545}$ in females.

Length-weight relationships were $\log W = 0.013 + 3.05 \log FL$ ($r = 0.81$) for males and $\log W = 0.019 + 2.98 \log FL$ ($r = 0.75$) for females. The exponent of the length-weight relationship was not significantly different between the sexes ($P > 0.05$), neither was it significantly different from the value 3 ($P > 0.05$), and ranged between 3.05 and 2.98, which means an isometric growth pattern.

Relations between the different lengths of the same samples were $FL = -2.087 + 1.053 TL$, $SL = -3.166 + 1.026 TL$ in males, and $FL = -0.801 + 0.962 TL$, $SL = -1.796 + 0.952 TL$ in females.

Age groups ranged between the II and VII year classes with few fish caught outside this range. This may be ascribed to gear selectivity. Furthermore, 3-, 5- and 4-years old fish, in descending order of importance, were the most common, as illustrated in Figure 2. The sex ratio did not deviate significantly from 1:1 (χ^2 , $P > 0.05$). Smaller or older specimens were not caught.

Examined samples showed that 70% of males and 75% of females mature in the second year of age, but all 3-years-old individuals, and older ones, have mature gonads and are able to reproduce (Figure 3). Length and weight at first maturity are shown in Table 1 for the age groups.

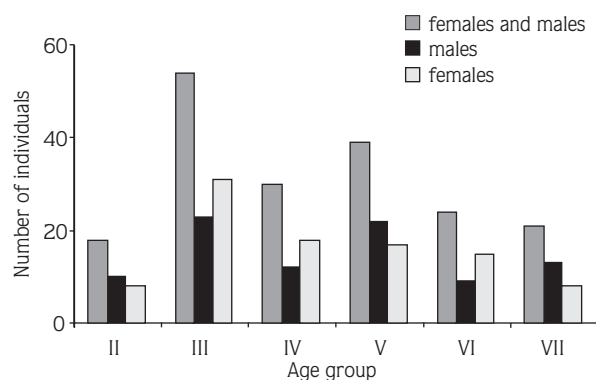


Figure 2. Sex distribution within each age group of himri barbel in the intermediate Euphrates River's reaches.

Fecundity increased with length, weight and age, ranging from 2455 to 26300 eggs per female. Relationships between absolute fecundity (F) and fork

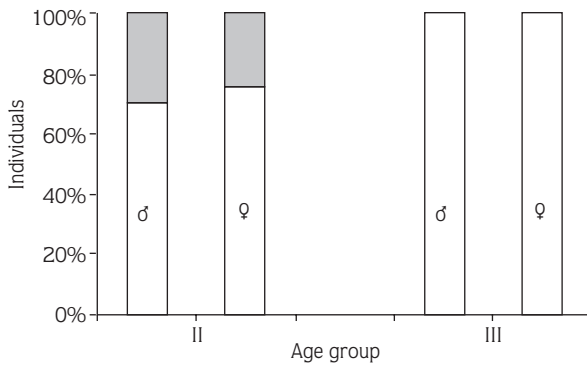


Figure 3. Percentages of mature II and III year old himri samples in the pre-spawning and spawning season. ■; mature, □; immature.

length, total weight (W) and age (T) were $F = 0.108 FL^{2.810}$ ($r = 0.86$, $P < 0.05$), and $F = 1.209 W^{1.084}$ ($r = 0.63$, $P < 0.05$), $F = 2.721 T^{1.946}$ ($r = 0.74$, $P < 0.05$), respectively.

Discussion

The growth in length and weight of himri in the Iraqi part of the Euphrates River was slightly higher (Szypula et al., 2001) than that at Syrian sites. This is probably due to variations between the habitats and localities

within the 2 reaches in physiochemical and biological factors affecting fish growth, especially in the eutrophic Iraqi dam lakes as reported by Zdanowski et al. (2001a, 2001b).

Compared to other *Barbus* species from the same basin, the himri is smaller in size than *B. plebejus lacerta* (Ünlü et al., 1990), *B. grypus* and *B. xanthopterus* but similar to *B. sharpeyi* (Szypula et al., 2001). The slopes of the length-weight regression lines were similar in males and females. This value ranges between 2.5 and 4 according to species, sex, age, sexual maturity of fish, season and fish feeding (Ricker, 1975).

Age distribution was dominated by the young age groups, which can maintain the species and population. However, no samples of the I year old class were caught. The most abundant year class was year class III, followed by the fifth year class. This unexpected distribution may be explained by the selectivity of the sampling nets used. Szczerbowski et al. (2001) noted such selectivity for the himri previously.

Male and female himri attain sexual maturity in their second or third year of life when they have reached a total length of between 152 mm and 157 mm in the middle part of the Euphrates River. Many cyprinid species

Table 1a. Number, mean weight W (g) and mean fork length FL (cm) of himri, *Barbus luteus*, males.

Age	Male		
	n (% n)	W	F L
II	10 (55.5)	87.25 ± 7.51	13.6 ± 1.9
III	23 (42.5)	156.83 ± 10.71	16.9 ± 1.2
IV	12 (40.0)	280.17 ± 32.31	20.3 ± 1.9
V	22 (56.4)	510.14 ± 23.68	25.6 ± 1.7
VI	9 (37.5)	630.08 ± 29.89	30.3 ± 1.4
VII	13 (61.9)	646.90 ± 32.52	31.2 ± 2.1

Table 1b. Number, mean weight W (g) and mean fork length FL (cm) of himri, *Barbus luteus*, females with female's mean of total fecundity F (egg).

Age	Female			
	n (% n)	W	F L	F
II	8 (44.4)	91.29 ± 9.95	14.3 ± 1.1	2455 ± 204.4
III	31 (57.4)	162.97 ± 13.55	17.1 ± 1.7	3914 ± 436.3
IV	18 (60.0)	293.35 ± 22.14	21.5 ± 2.2	6690 ± 513.2
V	17 (43.5)	531.10 ± 26.85	27.2 ± 2.3	10140 ± 665.8
VI	15 (62.5)	655.04 ± 28.42	30.1 ± 2.5	20163 ± 854.6
VII	8 (38.0)	683.5 ± 33.75	31.8 ± 1.8	26300 ± 1080.4

have been reported to attain sexual maturity at the same age in nearby regions (Ünlü and Balci, 1993; Ünlü et al., 1994; Yıldırım et al., 2001).

Fecundity estimates in females were high and correlated to fork length, age and total weight. These

patterns were similar to other barbels (Lobon-Cervia and Fernandez-Delgado 1984; Balci et al., 1990; Yıldırım et al., 2001). At the same time, himri males were able to produce significantly large quantities of milt (Al Hazzaa and Hussein, 2003).

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