Reproductive Biology of Himri Fish, *Barbus luteus* in Tigris River (Southern Baghdad)

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Abstract

The study aimed to investigate biology and reproductive stages of Himri fish, *Barbus luteus* in Tigris River Southern Baghdad. Total of 232 males and 241 females were captured between January and December/ 2014, then immediately transferred to the laboratory and dissected for general biological parameters and gonads description. Results showed that both sexes have five reproductive stages named; resting, maturation, pre spawning, spawning, and post spawning. Spawning take place in May to July when the mean of the temperature was 24.7˚ C. Results also revealed that the highest Gonad Somatic Index (GSI%) in females was 9.17 % in May, while the lowest value 0.47% was found to be in September, it was significantly differed from that of other months. Corresponding values of GSI% for the males were 5.93% and 0.26% in May and September respectively. In conclusion, himri fish reproduce annually with five accompanied stages for male and female, expressed their reproductive stages in different speed rates and spawning take place in May-July.

Key Words: *Barbus luteus*, Reproductive Biology and Tigris River.

حياتية التكاثر لاسماك الحمري *Barbus luteus* في نهر دجلة (جنوب بغداد)

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الخلاصة

هدفت الدراسة الى التعرف على حياتية ومراحل دورة التكاثر لاسماك الحمري *Barbus luteus* في نهر دجلة جنوب بغداد. تم صيد ٢٣٢ ذكر و٢٤١ أنثى في المدة بين كانون الثاني وكانون الأول/ ٢٠١٤ ونقلت مباشرة إلى المختبر وشرحت لأخذ القياسات البيولوجية العامة ووصف المناسل. أظهرت النتائج أن لكلا الجنسين خمس مراحل تكاثرية سميت بمراحل الراحة والنضج وقبل السرء والسرء وما بعد السرء. وجد ان مرحلة السرء تحدث في أيار إلى تموز عندما يكون معدل درجة حرارة الماء ٢٤.٧ ˚م . أظهرت النتائج أيضا أن أعلى دالة مناسل للإناث ٩.١٧% كانت في شهر أيار بينما اقل دالة ٠.٤٧% كانت في أيلول واختلفت معنويا عن بقية الأشهر. أما القيم المناظرة لها في الذكور فكانت ٥.٩٣ و٠.٢٦% في شهري أيار وأيلول على التوالي. خلصت الدراسة إلى أن اسماك الحمري تتكاثر مرة في السنة وتمر بخمس مراحل تكاثرية متزامنة لكل من الذكور والإناث وان مرورها بالمراحل التكاثرية يكون بسرع مختلفة وتسرء في الفترة بين أيار و تموز .

الكلمات المفتاحية: حمري , حياتية التكاثر و نهر دجلة.

Introduction

As other vertebrate, fishes have powerful capacitating to regulate their life cycle. It should successfully reproduce once at least to keep maintaining their species. For this purpose, endogenous (Physiological) and exogenous (Ecological) factors have to be accompanied by the fish for successful reproduction. In nature, fishes have a unique strategy to do this mission, most of them spawn once a year, while there are some species spawn continually and more than one time a year (Devlin and Nagahama, 2002). Either single or multiple spawning, the reproductive cycle correlates mainly with temperatures (Adia, 1988) or/ and photoperiods (Bye, 1985), as well as, with many other minor factors such as, soluble oxygen, feeding level, culture density, nest available, and physiochemical properties of the water (Dufour, 1994; Baggerman, 1990; Thorpe, 1990). Determination of gonad maturation stages have been considered as important tool for reproductive cycle studies. If fish reproduce, some phenotypic, structural, and histological development will appear when reproductive stages were advanced (Sutharshiny, *et al*., 2013; Horvath, 1986).

Himri, *B. luteus* is one of the wild desirable fish found in the inland water of Iraq and have a tasty meat and high feeding value, it's easy to domesticate and reared under intensive poly culture system (Epler, *et al.,* 2001). This fish has relatively long life with 7 and 9 years for male and female respectively (Gokcek and İhsan, 2008). The deterioration in aquatic ecology causes contentious changes of the niche then decreased natural stock of fish population. Himri suffered from increasing the aquatic eco-pollution (Gokcek and İhsan, 2008), in addition, data base of the reproductive biology of himri fish deserve to support. The aims of this study were to investigate the reproductive stages of himri males and females and illustrate the relationship of these stages with temperatures mean in Tigris River Southern Baghdad.

Materials and Methods

Himri, *B. luteus* fish were collected from Tigris River-Alzaafarania region 20 Km Southern Baghdad in the period of Jan. to Dec. /2014 using gill and floating nets. Fishes were transferred immediately to the laboratory for the primary biological evaluation including, total length (cm), total weight (gm) and age (year) for both sexes. Samples were dissected to determine and descript maturation stages depending on gonads volume, weight, color, occupation of the body cavity, adhering to the dorsal side, mature ovum presents or milt droplets exit after slight abdomen squeeze, membranes transparency and blood vessel appearance. Water temperatures were recorded weekly with the aid of thermometer. Gonad Somatic Index (GSI %) were calculated by the equation:

(GSI %) = gonad weight (gm) / body weight (gm) x 100

Data were statistically analyzed and significant differences at $p \leq 0.05$ level between the means were assessed by Duncan multiple range test supplied by SPSS software (SPSS, 2001).

Results and Discussion

Total of 232 males and 241 females of Himri were captured from Jan. to Dec. of 2014, the general biological traits of the males and females sample were illustrated in Tables (1) and (2) respectively.

Table (1) Means of Some Biological Traits for Males Himri, *B. luteus* Captured from Tigris River Southern Baghdad.

Months	Fish captured	Age (year)	Total length (cm)	Total weight (gm)
January	٢٠	3^+	23.10	166.30
February	٢٩	3^+	22.70	172.90
March	٣٣	2^+	21.23	147.94
April	١٦	3^+	21.48	146.23
May	٢٠	3^+	23.28	128.71
June	١٨	3^+	20.88	133.57
July	١٢	2^+	19.34	118.69
August	١١	2^+	19.84	97.91
September	١٣	2^+	19.55	66.14
October	١٨	3^+	21.67	101.75
November	١٨	2^+	20.73	145. 78
December	٢٤	2^+	22.78	132.71

Table (2) Means of Some Biological Traits for Female Himri, *B. luteus* Captured from Tigris River Southern Baghdad.

Months	Fish captured	Age (year)	Total length (cm)	Total weight (gm)
January	٣٤	4^+	21.87	146.88
February	٢٢	2^+	26.06	201.74
March	١٥	2^+	27.56	300.82
April	٢٨	2^+	24.59	211.83
May	٢٤	2^+	26.23	138.13
June	١٥	2^+	19.58	98.23
July	٧	2^+	21.98	175.18
August	٨	4^+	22.53	160.20
September	٩	2^+	19.34	118.67
October	٢٧	3^+	17.09	121.21
November	٢٦	3^+	21.04	140.03
December	٢٦	3^+	20.06	110.08

Age, Total length and Total weight for males and females ranged between (2^+ - 3^+ and 2^+ - 4^+ years), (19.34 - 23.28 and 17.09 – 27.56 cm), and (66.14 - 172.90 and 98.23 – 300.82 gm) respectively. In general, females showed extended ranges

especially in the total weight compared with males, this is true due to the large quantity of the yolk which is required later for the embryo and larvae growth. All fish specimens in the current study were reaches sexual maturity in 2nd – 3rd years of their lifespan, the same results were recorded by Al Hazzaa, (2005) but with longer length of fish.

Five stages were determined for both sexes of Himri depending on the special traits of the reproduction and were named; resting, maturation, pre spawning, spawning, and post spawning (Table3).

Table (3) Description of Maturation Stages in Males and Females Himri, *B. luteus* Captured from Tigris River Southern Baghdad.

Maturation stages	Male(testis)	Female(ovary)
Resting	Thin brawn threat near or adhered to the dorsal abdomen, (Sep. - Feb.)	Smooth tubule structure, gray color, difficult to see the ovum but blood vessels was seen, (Sep. – Mar.)
maturation	Thin opaque brawn tubules larger than previous period, (Jan. – Mar.)	Thin tube, purple in color with small transparent ovum, (Mar. – Apr.)
Pre spawning	Increase in the size to occupy half of body cavity, color change to grayish whit, (Apr. – May)	Large tube, increased in weight and size to occupy 2/3 of body cavity, ovum was seen easily with yellowish green color, (Apr. – July)
Spawning	The same grayish whit but decreased in size with exit of unique milt droplets under light squeezing, (May – July)	Decreased ovary size but with large and separate ovum, grayish green color, (May – July)
Post spawning	Smooth flaccid sac gray in color with some bloody tissues, (July – Aug.)	Partially empty sac with some clotted separate large ovum, (Aug.)

Due to the high increase followed by the sharp decrease in the gonad weight and GSI index and extended changes in the gonad morphology specially in the late stages (pre spawning and spawning), the spawning season were determined to be in May to July. Many authors reported that fish species differed in the number and descriptions of the reproductive stages, this fact may also appear within the same species according to the procedures, descriptive accuracy, and the situation of the study. In this trend, maturation stages of himri in the study of Ahmed *et al.*, (1984) was nine, while its five in Bhatti and Al-daham (1978), and six in the histological study of Rahemo and Al-Shatter (2012). Table (3) revealed

that himri fish expressed their reproductive stages in different speed rates. It stays in the resting stage for six months, whereas one and two months in the post spawning stage for females and males respectively. It's clear that developing of stages occurred in very slow manner in the beginning of the reproductive cycle and fasted with the last stages reaching the spawning stage. This strategy in reproduction may correlated with temperature changes, the same trend was seen previously for another Cyprinid fish (Kattan, *Barbus xanthopterus* and Shabbot, *Barbus grypus*) by Albiaty (2000) in Tigris River. In addition, maturation and pre spawning stages (growth and development periods) in the current study continued for five months while it's just three in the study of Alkhafagi (1988) for the same species, in other species (Cat fish, *Heteropneustes fossilis* and common carp, *Cyprinus carpio*) it's also five months (Almosawi, 1990; Alawadi, 2007 respectively). However, synchronized spawning activity in males and females in May to July was relatively agreed with Al Hazzaa and Hussein (2003) in Euphrates River in Turkey.

The appearance of Himri gonads in earlier stages were steadily changed and developed toward spawning, increased in volume, easily differentiated by eyes and milt and eggs exits under light abdominal squeeze, then return back to the initial status (Table 3) that means their reproductive cycle is annually. The increasing gonad weight and volume could be attributed to one or more of the following causes; anabolic activity and accumulation of nutrients in the reproductive tissues (Omotosho, 1993); increasing their precipitate contents of protein and lipid (Yesser,1988); or supplying nutrients from muscles and other organs (transformation) in the food shortage periods (Koehn, 2004). The yellowish- green color appeared in Himri mature ovary may be a result of yolk accumulation as it's the same indicator for developing Carp, *Cyprinus carpio* ovary (Swee and McCrimmon, 1966). There are many studies (Rahemo and Al-Shatter (2012); Bardakci *et al.* (2000); Al-Nouri (1996); Al–Daham and Bhatti (1979) which ensure that Himri mature ovary has granular yellow shape occupying 2 / 3 of body cavity which is the case in the current study. Spawning activity in May to July is a definite indicator for gonad developments in previous period (spring) when reached the highest level. This matter considered as common phenomenon for almost all fish species especially in Cyprinidae (Al Mukhtar *et al.*, 2006; Al Hazzaa, and Hussein, 2003). On the other hand, the continuous spawning activity for three consecutive months has been indicated either the long spawning season or partial spawning habits of Himri fish which was found to be in agreement with Dorostghoal *et al.* (2009); Al Hazzaa and Hussein (2003); and Al–Daham and Bhatti (1979).

Table (4) illustrate that there were significant changes ($p \leq 0.05$) in GSI% through the reproductive cycle, GSI% increased to the highest level in May (5.93% and 9.17% in male and female respectively) before declined to the minimum level of 0.26% and 0.47% respectively in September. To far extent, our results confirm what other researcher reported in local Iraqi fishes (Albiaty, 2000; Abed, 1995; Naama *et al.*, 1986;

Ahmed *et al.,* 1984) that fishes matured in spring with top level of GSI% before gradual decline. Beside, GSI% was highest in females compared with males indicating the requirements of embryo and larvae to marked quantities of food for survival and growth. This fact is true and agreed by Kapil *et al.,* (2011) and Manna *et al.,* (2010).

Table (4) Monthly Variation in GSI% and Maturation Stages for Himri, *B. luteus* Captured from Tigris River Southern Baghdad.

Month	Temperature	Sex	GSI% (S.E)	Maturation Stage
January	15.4 F	Male Female	0.96 (0.82)CD 0.99 (0.10)D	٢-١ ١
February	17.1 E	Male Female	1.52 (1.01)CD 1.83 (0.63)D	٢-١ ١
March	19.2 D	Male Female	3.91 (1.14)B 3.83 (1.44)C	٢ ٢-١
April	19.5 D	Male Female	5.67 (2.79)A 6.38 (5.91)B	٣ ٣-٢
May	24.7 B	Male Female	5.93 (1.51)A 9.17 (1.39)A	٣ ٣
June	27.8 A	Male Female	3.29 (1.41)B 5.40 (2.05)B	٤ ٤-٣
July	28.9 A	Male Female	1.75 (0.84)C 5.39 (1.97)B	٥-٤ ٤-٣
August	28.4 A	Male Female	0.51 (0.30)CD 1.39 (0.98)D	٥ ٥
September	24.2 B	Male Female	0.26 (0.17)D 0.47 (0.20)D	١ ١
October	22.5 C	Male Female	0.30 (0.13)D 0.63 (0.29)D	١ ١
November	15.5 F	Male Female	0.63 (0.34)CD 1.25 (0.51)D	١ ١
December	17.9 E	Male Female	0.73 (0.19)CD 1.69 (1.11)D	١ ١

Different letter for the same sex indicates significant differences ($p \leq 0.05$) between months.

The continuous increase in GSI% were accompanied with developing stages, Shengde and Mane (2006) outlined that GSI% were correlated directly with spawning stage and inversely with post-spawning stage. It seems that decreased GSI% in September is probably a result of exhausting gonad components, huge spawning activity, and ovum reabsorbing (Kapil *et al.*, 2011; Adamassu, 1996). In contrast, the highest level of GSI% in May indicate the initiate of spawning stage, while the medium GSI% in March and April reflects the gonads

construction stages. These phenomenons were observed in many Cyprinidae species (Alawadi, 2007; Albiaty, 2000; Yesser, 1988) and other family of fish (Esmaeili *et al.*, 2010; Duarte *et al.*, 2007).

Water temperatures in Tigris River were significantly changed ($p \leq 0.05$) in the different months with highest and lowest means in July and January respectively (Table 4) which were synchronized with final and earlier maturation stages respectively. In May, when the mean temperature was 24.7˚C the GSI% reaches the maximum level, but important construction stages in gonads were observed in spring when mean temperature increased gradually from 19.2 in March to 24.7˚C in May, the same trend were found in Carp fish (Singh *et al.*, 2005; Nathanael and Edirisinghe, 2001) and *L. spixii* fish from Lajes Lake in Brazil (Duarte *et al.*, 2007). However, Himri spawning season in Turkey took place in June and July with the temperature limits of 22-25 ˚C. (Al Hazzaa, and Hussein, 2003). Generally, fishes may spawn in wide range of water temperatures, Yildirim *et al.*, (2001) reported that *B. plebejus* fish spawn in Coruh River in Turkey when the temperatures being 14-19˚C., in other species (*C. meridionalis*, *G. acleatus*, and *Cyprinus carpio*), spawning temperatures were considered as essential stimulating factor for milt and eggs deposition and being 14; 15-20; 17-26 ˚C. (Peterson *et al.*, 1999; Wootton *et al.*, 1978; Dawood, 1986 respectively). However, the spawning habits of Himri fish in other studies take place in March (moderate temperature) and June-July (hot) (Yousif, 1983; Al Hazzaa and Hussein, 2003 respectively).

The study concluded that, Himri fish reproduce annually with five accompanied stages for male and female, and spawning takes place in May- July when the water temperature was 24.7-28.9˚ C.

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