The Status of Himri Fish, *Barbus luteus* (Heckel) Population in the Al-Huwazah Marsh, South Iraq

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Abstract:

A total of 1647 specimens of himri *Barbus luteus* were used to describe the status of himri population in the Al-Huwazah marsh, south Iraq from October 2005 to December 2006. The relative abundance of *B. luteus* formed 29.4% of the total catch. The lengths of fish were ranged from 3.0cm to 35.0cm and the most dominant length groups observed were those of 11 to 21 cm. Total length-weight relationship was estimated as W = 0.0104 $L^{3.084}$. The lengths of fish were 8.5, 15.5, 20.0, 24.0, 27.0, 29.0, 31.0, 32.5 and 33.5 cm at the end of 1-9 years respectively. Growth and mortality parameters estimated were: $L\infty$= 37.0cm, K= 0.26, Z= 0.957, M= 0.336 and F= 0.621. Therefore, it may be claimed that the *B. luteus* in the Al-Huwazah marsh is being overfished, and a better management policy is necessary in this area.

Keywords: Himri barble; *Barbus luteus;* growth; mortality; marshes

I. Introduction:

The Cyprinidae are among the most important and dominant families of fishes in the freshwater systems of Iraq include more than 68 species and the genus *Barbus* alone contains more than 12 native species [1]. The himri barbal, *Barbus luteus* (Heckel), is a cyprinid that is endemic and widely distributed in the Mesopotamian, both lotic and lentic habitats [2, 3, 4]. [5] recorded this species from 2km southward of Fao city, Iraq in a pure marine habitat (salinity 30-47‰) during the flood season of April 1992. This fish is considered one of the most important species for artisanal fisheries and is consumed domestically as fresh fish. [6] reported that the total landing of *B. luteus* was five tons, constituted 43.6% from the total fish landings at seven main wholesale markets in Iraq during 1965. [7] state that the contribution to the landings of major cyprinid fish species (*B. sharpeyi*, *B. xanthopterus* and *B. luteus*) at Basrah markets, Iraq were 36.4, 24.1 and 12.6%, respectively during October 1975 - June 1977. [8] mentioned that the cyprinids species; *B. sharpeyi*, *Aspius vorax* and *B. luteus* were dominated the artisanal fishery of Swab river which is part from Al-Huwazah marsh, Iraq and represented 24.5, 10.4 and 8.6% of the total fish landing during 2005, respectively.

Several studies have been done on the biological characteristics of *B. luteus* at different water bodies of Iraq [9, 10, 11, 12, 13], Syria [14] and Turkey [15], but there is little information on its stock assessment [16, 17]. Even the Al-Huwazah marsh is considered as one of the major source of freshwater fishes in Iraq, no proper studies

were conducted about the stock assessment of this species. Therefore, the specific objective of this work was to assess the stock of himri, *B. luteus* in this marsh after restoration.

II. Materials and Methods:

A. Study area

The Al-Huwazah marsh lies to the east of the Tigris River, straddling the Iraq-Iran border (Fig.1). The Iranian section of the marsh is known as Hawr Al-Azim, where it is fed primarily by the Karkheh River. In Iraq, this marsh is largely fed by two main distributaries departing from the Tigris River near Amarah, known as Al-Musharah and Al-Kahla. Its surface area is approximately 3,000 km² with a maximum depth of 6 m [18]. The northern and central parts of the marsh are permanent, but towards the southern sections they become increasingly seasonal in nature. The permanent marsh is typically characterized by moderately dense vegetation alternating with open stretches of water.

Fig. 1. Map of southern of Iraq, showing the location of Al-Huwazah marsh

Draining of the Al-Huwazah marshland began with construction of oil fields (Majnoon Island) and during the Iraq-Iran war (1980-1988). The marsh was further dried during the 1990s by water diversion through the construction of embankments along the Tigris River and its distributaries and by construction of a dam on the Karkheh River in Iran. By 2002, only about a third of the Al-Huwazah marsh was remained [19], however, this represented the only remaining portion of the Mesopotamian Marshlands. In 2003, several of the embankments were breached and water from the Tigris River is returning [20]. Water temperature of the marsh was changed from 13°C in January to 32°C in July, with mean value of 23.2°C, and salinity ranged from 0.4‰ in June and July to 1.5‰ in November, with mean value of 0.8‰ [21]. These marshes were characterized by thickets of aquatic vegetation, generally consisting of common reed, *Phragmites australis* and rushes, *Typha domingensis* [22, 23].

B. Fish Samples

A total of 1647 specimens of *B. luteus* individuals were collected monthly from two selected sites (Um Alnaaj and Taraba) in the Al-Huwazah marsh (Fig. 1) from October 2005 to September 2006 as part of a larger study to investigate the composition of the fish community in this marsh [21]. Sampling was carried out using seine net (20 m long with a 2.5 cm mesh), fixed gill nets (500 to 100 m long with 2.5 cm to 10 cm mesh size) and electro-fishing gear. Specimens were immediately transported to the laboratory on crushed ice for subsequent analysis.

C. Analytical methods

The relative abundance (%) of the species was calculated [24] as: $ni/N * 100$, where, ni = number of individuals of the species in the monthly sample and N = total number in the monthly sample.

The total length of each fish was measured to the nearest 0.1 cm and the weight recorded to the nearest 0.l g. The length-weight re1ationship was obtained by fitting the equation [25]: $W= a L^b$, where W= fish weight, L= total length and a and b are constants. Relative condition factor (Kn) was calculated from the formula $Kn= W'/W$, where W'= the observed weight and W= the calculated weight.

The length cohort analysis [26] was used to obtain size-at-relative age data, from which growth and mortality rates could be calculated. The lengths of fish were combined into 1.0 cm length classes to plot the length frequency distributions and to length cohort analysis. The seed value of $L\infty$ was calculated using Taylor's equation [27]: $L\infty=L_{max}/0.95$ (where $L\infty$ is the asymptotic length and L_{max} is the largest fish measured in the samples). A value of the $L\infty$, was taken as 37cm as the largest fish was 35cm. To estimate the K value, the following equation was used: ($K= In [((L\infty-L_1)/(L\infty-L_2))1/t$), where, L_1 and L_2 are observed lengths relevant to two ages of time t apart [26]. The K value obtained was 0.26. The parameter Φ, the growth performance index, was calculated as $\log_{10} K + 2 \log_{10} L_\infty$ [29].

An estimate for the annual instantaneous rate of total mortality (Z) was attempted from length-converted catch curve [29]. The natural logarithm of the number of fish in each relative age group divided by the change in relative age was plotted against the relative age, and Z was estimated from the descending slope of the best fitting line with least-squares linear regression. The annual instantaneous rate of natural mortality (M) was obtained by applying Pauly`s equation [30]. The mean water temperature in this instance was 23.2^{o}C [21]. The annual instantaneous rate of fishing mortality (F) was calculated by subtracting the natural mortality rate (M) from the total mortality rate (Z) derived from age-based catch curves. The exploitation rate (E) was calculated as the proportion of the fishing mortality in relation to total mortality, $E=F/Z$ [31]. Three analytical methods were used to analyze stomach contents, i.e. numerical, volumetric and frequency of occurrence [32]. The importance of food item was determined by using the index of relative importance (*IRI*) of [33].

III. Results and Discussion:

A. Relative abundance

A total of 4,715 fishes from 15 species were collected from the Al-Huwazah marsh during October 2005 to September 2006. Of these, three species, *Liza abu*, *B. luteus* and *Carassius auratus* comprised 37.1, 29.4 and 15.3% of the fishes collected at the marsh, respectively. The remaining species comprised 24.2% of the catch. The relative abundance of *B. luteus* fluctuated from 5.3% in November to 72.7% in December (Fig. 2), with an overall value being 29.4% of the total catch. *B. luteus* was the dominant species in the marsh for six months, October to January and March to May, with a peak in December.

B. Length frequency distributions

The monthly length frequency in Fig. 3. The smallest fish recorded was 3.0cm captured during December 2006 and the largest one was

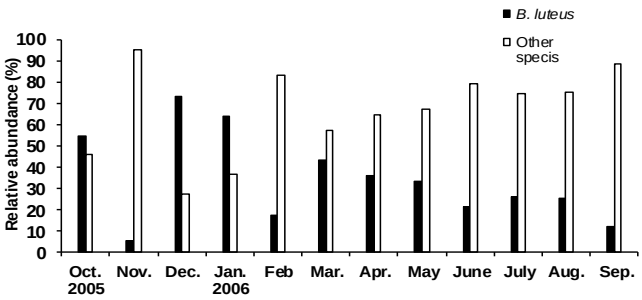

Fig. 2. The relative abundance of *B. luteus* in the Al-Huwazah marsh

35.0cm collected during April. The small fish (<10cm) were appeared in the catch during September, October, December and January and the large fish (>30cm) were caught during February, April, May and August. The fish lengths (16-21cm) were dominant in the catch during the most of the months. Neither small fish (<15cm) nor large fish (>24cm) were captured during November, therefore the number of fish caught during this month was the lowest.

The monthly samples were pooled to produce a single length frequency distribution which should be representative of the mean size structure of the captured fish during the study period (Fig. 3). The most dominant length groups observed were those of 11 to 22cm representing 79.7% of the total number.

C. Length-weight relationship and condition factor

Length and weight measurements of 449 specimens were used to describe the length-weight relationship of *B. luteus*. Their total lengths varied between 7.8 and 33.0 distributions of 1647 *B. luteus* are presented cm, while the total weights ranged between 6.0 and 485g. The obtained equation was as follow: $W = 0.0104\ L^{3.084}$ with a regression coefficient r= 0.997. The exponent is close to 3.0, so that *B. luteus* shows little change in body proportions with growth. The relative condition factor ranged from 0.881 for a mean length of 15.4 cm to 1.165 for a mean length of 30.5 cm (Table I), with overall mean value 1.002.

D. Growth

Results of cohort analysis of 1647 individuals ranging from 3.0 to 35.0 cm are presented in Table II. The growth curve of *B. luteus* is constructed by plotting the length against relative age. It is suggested that *B. luteus* may attain a size of 8.5, 15.5, 20.0, 24.0, 27.0, 29.0, 31.0, 32.5 and 33.5 cm at the end of 1-9 years respectively. The growth performance index (ø) of *B. luteus* was computed as 2.55.

E. Mortality rates

A length-converted catch curve for *B. luteus* is shown in Fig. 4, which is based on the data presented in Table II. The total annual mortality rate (*Z*) was 0.957 for fish in the total length from 17.5cm to 34.5cm. The natural mortality rate (*M*) was estimated as 0.336; therefore, the fishing mortality rate (*F*) was 0.621 and the exploitation ratio (*E*) was 0.649. *F. Food Habit* The stomach contents of 300 fish were examined for food habit. Seasonal variations in percentage of food components of *B. luteus* in the study area are illustrated in Fig. 5. Algae were the most important food items, with a percentage >36; more algae were taken in autumn 54.5% and less in summer 36.3%.

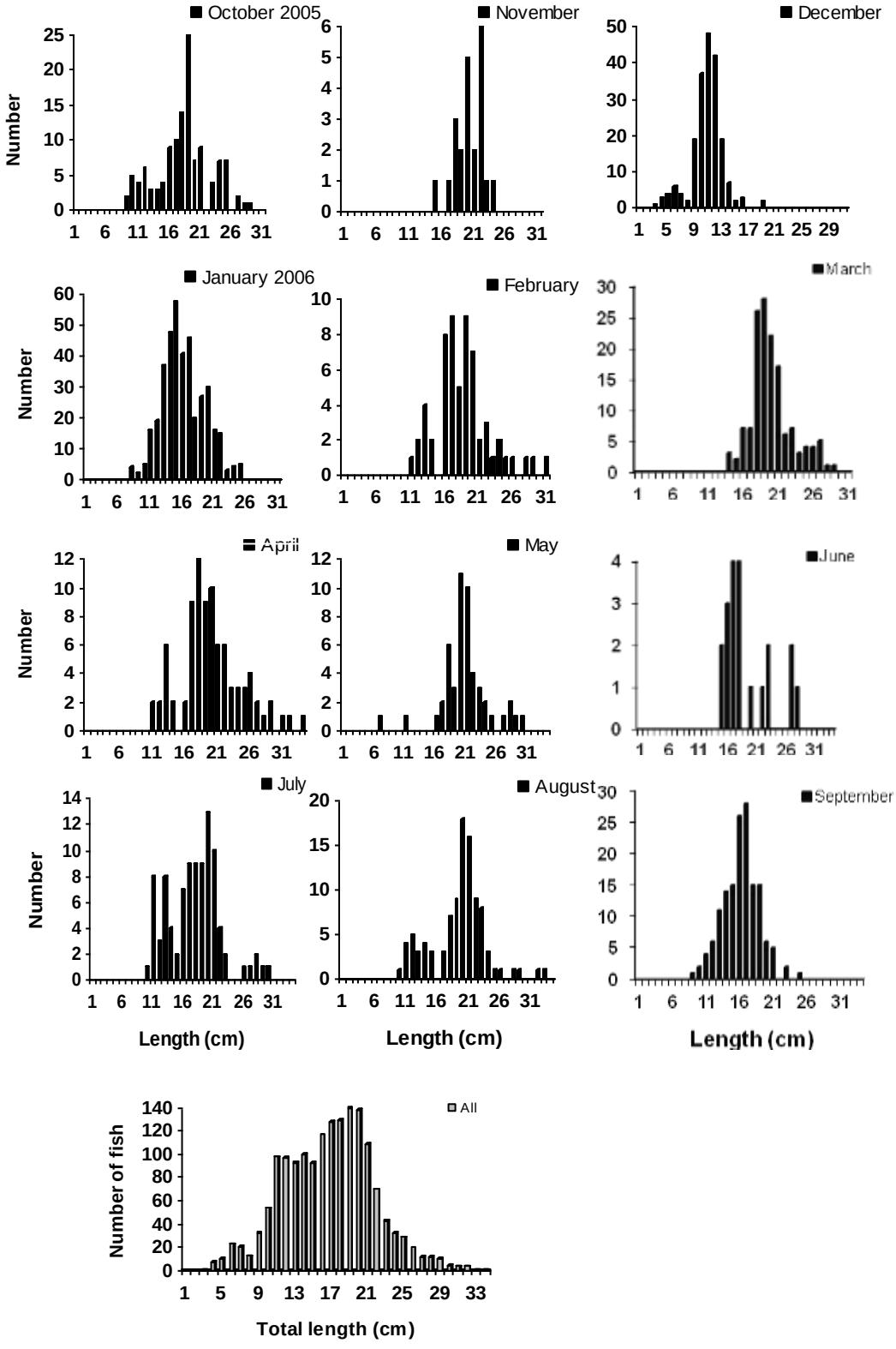

Fig. 3. The overall length frequency of *Barbus luteus* in the Al-Huwaza marsh

Mean length (cm)	No. of fish	Mean weight (g)	Calculated weight (g)	Kn
7.8	1	6.0	5.9	1.025
10.6	2	15.1	15.1	0.995
11.5	14	18.7	19.2	0.974
12.5	9	25.8	25.4	1.017
13.4	14	30.9	30.8	1.001
14.5	10	45.8	39.8	1.150
15.4	10	42.3	48.0	0.881
16.5	16	57.0	58.9	0.968
17.4	22	69.7	69.6	1.002
18.3	38	80.4	82.0	0.980
19.3	45	92.1	95.7	0.962
20.3	56	112.5	112.2	1.003
21.3	45	131.2	130.2	1.008
22.3	21	149.7	149.3	1.003
23.3	117	175.8	171.5	1.025
24.5	10	192.9	199.3	0.968
25.4	5	214.2	224.7	0.953
26.1	2	258.1	243.8	1.059
27.0	3	263.4	270.6	0.973
28.4	4	312.8	315.4	0.992
29.2	2	367.0	344.6	1.065
30.5	1	459.0	394.1	1.165
32.0	1	415.8	457.0	0.910
33.0	1	485.0	502.5	0.965

Length group (mm)	No. of fish	$ln(N/\Delta t)$	Relative age (t`)
30-39	1	2.27	0.38
40-49	8	4.32	0.49
50-59	11	4.61	0.61
60-69	23	5.31	0.74
70-79	21	5.19	0.87
80-89	11	4.51	1.00
90-99	33	5.57	1.13
100-109	52	5.99	1.28
110-119	98	6.58	1.42
120-129	97	6.53	1.58
130-139	93	6.45	1.74
140-149	100	6.48	1.91
150-159	93	6.36	2.08
160-169	117	6.54	2.26
170-179	128	6.58	2.45
180-189	129	6.54	2.66
190-199	140	6.56	2.87
200-209	138	6.49	3.10
210-219	109	6.19	3.34
220-229	70	5.68	3.59
230-239	43	5.13	3.87
240-249	33	4.78	4.16
250-259	29	4.57	4.48
260-260	20	4.11	4.83
270-270	12	3.50	5.21
280-280	12	3.39	5.64
290-299	11	3.18	6.12
300-309	5	2.25	6.67
310-319	4	1.86	7.31
320-329	4	1.66	8.08
330-339	1	0.02	9.05
340-349	1	-0.32	10.35

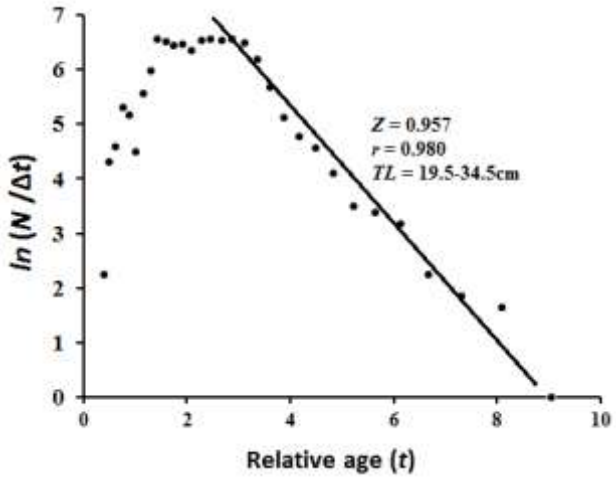

Fig. 4. The catch curve of *B. luteus* in the Al-Huwazah marsh

Diatoms as food item occupied the second position in diet at all seasons, but they made up their highest contribution in autumn (26.1%) and lowest in winter (19.4%). Higher aquatic plants occupied the third position at 15.2% in summer and 7.1% in autumn, but gave position to insects in spring (12.7%) and in winter (10.7%).

The overall percentage composition of dietary components of *B. luteus* was algae (46.6%), diatoms (22.1%), higher aquatic plants (10.5%), aquatic insects (8.9%), copepoda (5.0%), cladocera (3.8%), rotifera (1.8%) and snails (1.8%). The plant components formed 79.2% of the total food items.

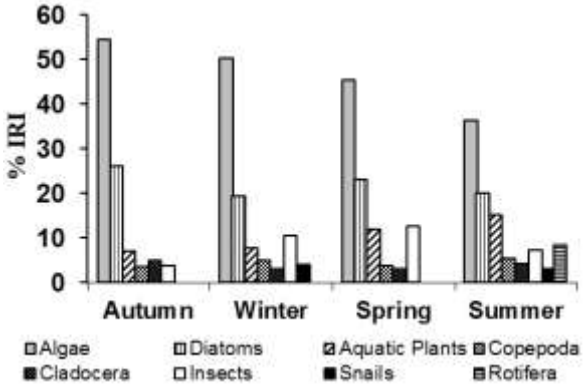

Fig. 5. Seasonal variations in food composition of *B. luteus* in the Al-Huwazah marsh

The contribution of *B. luteus* population in the total fish populations in Al-Huwazah marsh was higher than those recorded from the other southern marshes within the same time period and sampling efforts. The relative proportions of *B. luteus* in other marshes ranged from 1.65% in East Hammar marsh [34] to 4% in Chybaesh marsh [35]. Al-Huwazah marsh is non-tidal freshwater marsh and representing the best persevere natural marsh of the original Mesopotamian wetlands, less harshly degraded of the other southern marshes due to drainage operations [19]. According to [36], the highest number of aquatic plants was registered in Al-Huwazah marsh (35) in comparison with East Hammar marsh (24), and the aquatic macrophytes species restoration percentages during 2006 were 97.2% in Al-Huwazah, whereas, 63.2% in East Hammar. Also, the density and biomass of the major macrophytes species in Al-Huwazah marsh during July 2006 were 423 g/m² and 21,452 g/m² dry wt., respectively, while for East Hammar marsh were 308 g/m² and 11,367 g/m² dry wt., respectively [37].

The growth parameters estimates of *B. luteus* obtained in the present study were compared with the status of this species in the previous studies (Tables III and IV). The slopes of the length-weight regression lines for the species in the most waters were close to 3.0 (Table III), so that *B. luteus* shows little change in body proportions with growth. Such changes in the values of '*b*' may be attributed to fish feeding, major change in environment and stage of maturity [40]. The asymptotic length ($L\infty$) of *B. luteus* determined in the present study was lower than that of the Himrin Dam and Tharthar Lake, and was higher than that of

Table III: Growth parameters estimates of *B. luteus* in different ecosystems

Ecosystem	*b*	$L\infty$ (cm)	*K*	Φ`	Reference
Tharthar Lake, Iraq	3.010	38.0	0.29	-	[9]
Hammar marsh, Iraq	-	32.8	0.15	2.21	[38]
Garma marsh, Iraq	3.120	-	-	-	[11]
Himrin Dam, Iraq	2.100	46.0	0.15	-	[39]
Swab marsh, Iraq	3.007	35.0	0.131	2.23	[13]
East Hammar marsh, Iraq	3.224	37.0	0.26	2.59	[17]
Huwazah marsh	3.084	37.0	0.26	2.55	Present study

Table IV. Growth comparison of *B. luteus* in different ecosystems

Ecosystem	Mean total length at each age (cm)							Reference
	1	2	3	4	5	6	7	
Tharthar Lake, Iraq	8.0	16.0	21.0	24.5	28.0	31.5	32.5	[9]
Hammar marsh, Iraq	13.0	15.4	18.6	20.2	21.2	22.5	24.6	[38]
Garma marsh, Iraq	12.0	13.5	16.8	20.5	26	28	-	[11]
Swab marsh, Iraq	12.0	14.5	20.0	22.5	24.5	27.3	29.3	[13]
East Hammar marsh	10.5	16.6	20.9	24.6	27.6	29.9	-	[17]
Huwazah marsh	8.5	15.5	20.0	24.0	27.0	29.0	31.0	Present study

other waters (Table III). [17] found similar result for this species in East Hammar marsh. It has been reported that there must be some differences between the growth characteristics from one area to another for reasons of quantity and quality of food and hydrographical and climatic conditions [41]. The growth performance index (Φ) for *B. luteus* in the present study was higher than the values mentioned in Table III for the same species in other waters, except that reported by [17]. These different data from different regions may be related to the environmental conditions. The growth rate of *B. luteus* in the Al-Huwazah marsh can be compared favorable with other waters (Table IV), especially after the second year of life onward.

Analysis of food components indicated that *B. luteus* in the Al-Huwazah marsh was herbivorous. [42] stated that some fish species in the East Hammar marsh like *B. luteus* changed its diet to be herbivorous previously known as omnivorous with tendency to animal side [10].

The exploitation rate (*E*) of *B. luteus* in the present study is higher than that of the *E* values estimated for the same species in other waters, which were 0.31/year in Al-

Radwania Lake [43] and 0.48/year in the Euphrates River, Al-Mussaib [16]. It indicates that the stock of this species in the Al-Huwazah marsh is now under pressure of over exploitation. [17] found similar result (*E*= 0.58) for this species in East Hammar marsh. This assumption is based on [44] as he stated that suitable yield is optimized when *F= M,* i.e., when *E* is more than 0.5, the stock is generally supposed to be under overfishing. The comparatively high value of the exploitation rates of fish in the marshes can be attributed to several factors, one of them is illegal fishing methods employed such as the use of explosives, poisons and electric fishing and long-term use of illegal small-meshed nets, in addition to substantially reduction in water quality and quantity and effectively eliminated the flood pulses that sustained wetland ecosystems in the lower Tigris-Euphrates basin [19].

V. Conclusion and Recommendations:

The results indicated that the stock of *B. luteus* in the Al-Huwazah marsh is heavily exploited. It is necessary to immediately enforce fishing regulation on the fish stock in the marshes and this can be done by activating the national law of organizing fishing, exploiting and protecting aquatic resources, especially preventing the illegal fishing methods, increasing the mesh size of the gears, restricting fishing for certain seasons a declaring fish sanctuaries in certain areas, especially in spawning areas.

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