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GROWTH AND MORTALITY RATES OF *Cyprinus carpio* And *Aspius vorax* IN DYALA RIVER, SOUTH OF BAGHDAD

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ABSTRACT

A total of 164 specimens of common carp, *Cyprinus carpio* L. and 86 specimens of shilik, *Aspius vorax* were collected from polluted Diyala river region, south of Baghdad.

Growth and mortality rates were assessed using some biological parameters during the period of February/2000 to January/2001. The regression coefficient (b) values of length–weight relationship indicated that the growths of these two species are allometric.

C. carpio grew less rapidly in weight than in length. While, *A. vorax* increased in weight more than in length. The mean condition factor (k) of *C. carpio* was 1.02 and for *Aspius vorax* was 1.08. Age group of three years for both fish species was dominated and valued 38.5% and 27.9% respectively, whereas the lowest representative groups are 4 and 5 years with 8.9% and 12.0% respectively. The ultimate growth of length (L_∞) was 33.9 cm and 45.7cm respectively, and for weight (W_∞) was 217 gm and 827 gm respectively.

Cohort analysis, using Jones plot, and total mortality rate (Z) were 2.8 and 2.96 of both species, respectively.

INTRODUCTION

Many biologist all over the world developed a method to describe fish biology and their fish stock, to be able to cope efficiently and quickly, with many aspects concerning fisheries management (7). The estimation of age, growth, length-weight relationship, condition factor and mortality rate of fishes in different water bodies are important tools in fishery biology since details of species growth and mortality rates, age and life span can be calculated from such information (15).

Cyprinid fish are widely distributed all over the world and represents important commercial freshwater fishes distributed throughout Iraqi water bodies. Very little information is known about the growth and mortality rates of cyprinid fish in Diyala river. This water bodies are exemplified features of an influential tribe with relatively slow flow from the mountain headwaters to the final junction with Tigris river south of Baghdad Diyala river as pass through Rustamiya-south of Baghdad is polluted by the effluent discharge at this area. The present study investigation was under taken to study the population dynamics of these fishes that include age, growth, length–weight relationship, condition factor and mortality of *C. carpio* and *A. vorax* catches from Diyala river.

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MATERIALS AND METHODS

Fishes were sampled monthly during February 2000 to January 2001 from Diyala river south of Baghdad. Cast and seine nets with different mesh size were used. Total lengths of individual were measured to the nearest 0.1cm and total weights were recorded to nearest 0.1 gm. Age and growth of fishes were estimated by the annual growth in scale. Back-calculations were estimated according to Carlender and Smith (5 Condition factor (k) of total fishes were measured by the equation proposed by Ricker (15). Length-weight relationships were determined by the equation of Le Cren (11). Fish growth was based on the model given by Beverton and Holt (3). Length cohort analysis for fishes was estimated using Jones plot (14). Length infinity (L_∞) was estimated using Ford-Walford plot.

A total fish mortality rate (Z) were estimated from the linarite length-converted catch curve given by Pauly (14) plot according to opposite mean regression (b) for the relationship between the relative age and logarithmic frequency number to each length group [L n ($N/\Delta t$)].

RESULTS AND DISCUSSION

Length-Weight Relationship

A total of 78 specimens of *C. carpio* ranged between 11.3 to 25.0 cm in total length and 23.0 to 186.6gm in total weight, and 86 specimens of *A. vorax* ranges between 21.4 to 40.0cm 65.4 to 750.0gm were collected. The length-weight relationship was calculated using logarithmic regression equation and was as follows:

C. carpio: log W = 2.6 log L -1.4 (r=0.59, n=78 , P<0.001)
A. vorax : log W = 3.0 log L -3.1 (r=0.89, n=86, P<0.001)

The regression coefficient of b was 2.6 of *C. carpio* indicates that the weight was increasing less than in *A. vorax* (b=3.0) in which the weight follows slightly the cube. In the equation of length-weight relationship, the b value usually varies between 2.5 to 4 and 3.00 which indicated an isometric growth (11).

In the investigation of length-weight relationship of fish, care must be taken to avoid biases with respect to length, weight, sex, fishing gear and region of the water body (2), gill net of particular size trend to select wider fish among the longer ones (18).

However, different b values were recorded for C. *carpio* in different water bodies being 2.90, 2.80, 2.95 and 2.89 (1, 2, 4 and 12). Whereas b value for *A. vorax* was 2.85 in Al-Qadisiya reservoir (2). The value of b showed that the growth in weight was less than in length for *C. carpio* contrast with *Aspius vorax* .

Condition factor (K) of total individuals were 1.02, 1.08 in *C. carpio*, and *A. vorax* respectively. It was found that K-factor valued 1.006 and 1.005 for the same fish species respectively in Al-Habbanyah lake (8), whereas, K-factor was 1.59 for *C. carpio* and 0.93 for *A. vorax* in

Al-Qadisiya reservoir due to the lowest total weight to total length group for longer fish (2).

Generally, when total weight of fish increase more than the cube of total length, K-factor would increase with the increasing in total length and vica versa. So, the fluctuations in these values depend on the variance in total length group. Therefore, the mean values of K-factor for fish may be considered as a measure of the degree of well being of fish.

Age and Growth

Scale were used to estimate the back calculation in both *C. carpio and A.vorax*. It was found that population of both species is represented by different ages (from 1 to 5 years). The length groups from 14.1 to 18cm and 18.1 to 22 cm in total length dominated by the age group of 3 years for the both species respectively, whereas, fishes of 4 and 5 years age groups less abundant for both species. Data in table 1 and 2 shows that growth increment were attended during the first, second and third years for both fish species respectively, then increased markedly through later years.

Table 1: Mean of total length calculated (cm) of *C. carpio* at the end of each year in Diyala river

Age group (year)	Mean calculated total length at each annulus(n)					Mean capture length(cm)	Mean capture weight(gm)
	n1	n2	n3	n4	n5		
1	7.9	–	–	–	–	11.3	23.0
2	6.1	12.5	–	–	–	15.5	56.1
3	5.8	10.8	15.8	–	–	18.2	148.9
4	5.3	10.2	15.7	20.6	–	22.7	150.7
5	4.1	8.5	13.8	17.9	22.8	25.0	186.6
Mean calculated length	5.8	10.5	15.1	19.2	22.8	–	–
Annual increment (cm)		4.7	4.6	4.1	3.6	–	–

Table 2: Mean of total length calculated (cm) of *A.vorax* at the end of each year in Diyala river

Age group (Year)	Mean calculated total length at each annulus(n)					Mean capture length(cm)	Mean capture weight(gm)
	n1	n2	n3	n4	n5		
1	15.3	–	–	–	–	21.4	65.4
2	12.2	18.1	–	–	–	26.2	137.4
3	11.4	17.5	25.0	–	–	31.5	252.8
4	10.9	17.2	20.1	28.4	–	35.5	374.1
5	10.3	16.9	22.0	25.4	31.0	40.0	750
Mean calculated ength	12.0	17.4	22.0	26.9	31.0	–	–
Annual increment (cm)		5.4	4.6	4.9	4.1	–	–

The ultimate length (L_∞), weight (W_∞) was obtained using Ford–Wall ford plot and von Bertalanffy equation, The growth equations were as follows:

C. carpio:

$$L_t=33.9(1-e^{-0.1\,(t+0.05)})$$

$$W_t=217(1-e^{-0.1(t+0.05)})^{2.6}$$

A. vorax:

$$L_t=45.7(1-e^{-0.08(t+0.62)})$$
$$W_t=827(1-e^{-0.08(t+0.62)})^{3.0}$$

These equations showed that the L_∞ values for both species (33.9 and 45.7 cm) respectively were higher than maximum length (L max) of the capture fish which reached 28.2 and 43.1 cm respectively.

The maximum length for *C. carpio* was reached 75.0 cm in Al-Habbaniya lake (8) and 120 cm in Al-Hammar marsh (6) and 88.24 cm in one of artificial lake in Baghdad (1). While the L_∞ for *Aspius vorax* was 80 cm in Al-Habbaniya lake (8). Nikolisky (13) suggestion that seasonal variations in food usually gives the most rapid growth in cyprinid fish species, behind this, growth in fish in this family is more variable before reaching maturity, beside this, the growth can affected by the fish environments.

Furthermore, the errors in age determination by scales increased with increasing age of fish. As growth slows down, the annual rings became over-laped. So, age become increasingly hard to assess (17).

Length-Groups Cohort Analysis and Total Mortality

Table 3 and 4 showed the length frequency distribution to be 5 and 7 length groups. The data show that the oldest group aged 5 years for *C. carpio* and 7 years for *A. vorax* (Table 4). At the same time, fish specimens were decreasing in number for both species.

Table 3: Length-group cohort analysis for *C. carpio* in Diyala river

Length group (cm)	Mean length (cm)	t1	t2	Δt	Relative age (t')
6.1-10	9.8	1.4	1.8	0.4	1.6
10.1-14	13.8	2.1	2.8	0.7	2.4
14.1-18	16.9	3.1	3.8	0.7	3.4
18.1-22	21.2	4.3	5.1	0.8	4.7
22.1-26	25.9	5.4	6.3	0.9	5.8

Table 4: Length-group cohort analysis for *A. vorax* in Diyala river

Length group (cm)	Mean length (cm)	t1	t2	Δt	Relative age (t')
11.1-14	12.9	1.5	2.3	0.8	1.9
14.1-18	16.4	2.6	3.2	0.6	2.9
18.1-22	20.8	3.3	4.0	0.7	3.6
22.1-26	24.5	4.2	5.0	0.8	4.6
26.1-30	28.4	5.1	5.8	0.7	5.4
30.1-34	32.4	6.3	7.0	0.7	6.6
34.1-38	36.7	7.3	7.8	0.5	7.5

These results may be due to the mesh size which selected smallest or biggest fishes (8). As well as, in this polluted rivers may forced fishes with different sizes to immigrate and leave this aquatic zone (9).

A total mortality rate (Z) for *C. carpio* and *A. vorax* were 2.8 and 2.96 respectively (Figs. 1,2) while Al-Rudainy (1) recorded 1.12 for *Cyprinus carpio* in an artificial lake in Baghdad. He suggested that these values increasing with oldest age, because of the highe catch effort (F) compared with the natural mortality rate (M) thus, reducing the number of specimens in older and longer fish.

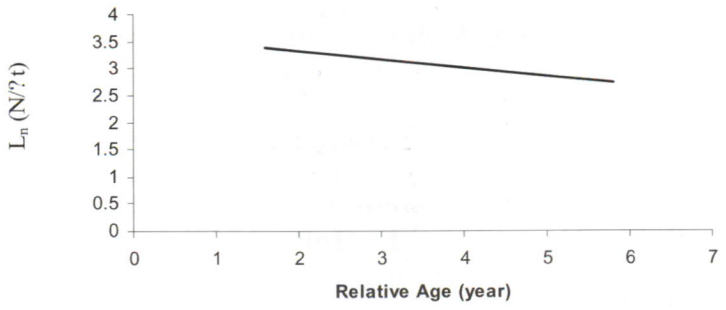

Fig 1: Catch curve of *C. carpio* in present study

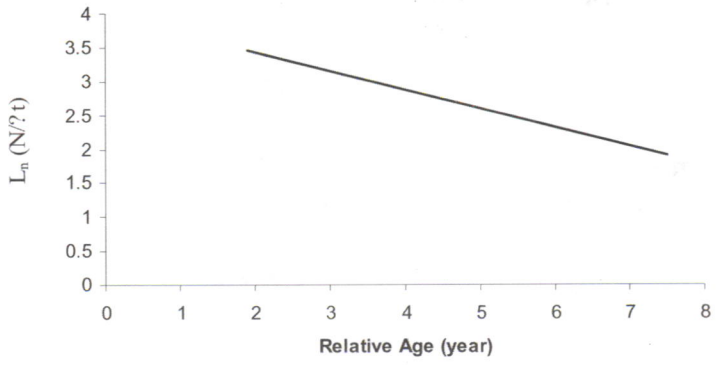

Fig 2: Catch curve of *Aspius vorax* in present study

In the present study, the total mortality rates of *C. carpio* were higher than that of *A. vorax*. The increment in these values were correlated inversely with L∞ and positively with K-values of growth equation, which was L_∞=33.9 and L_∞=45.7cm and K=0.1 and K=0.08 for both species respectively. Similar observaitions were recorded in previous study (16, 1).

Our finding showed that *A. vorax* growth was greater in groth rate than that of *C. carpio* at Diyala river near Baghdad. Furthermore, there was a relative increase in both weight and length of *A. vorax*, as advanced in age as compared to *C. carpio*. So, the results shows that the growth rates of the both species were significantly lower in a polluted area than revealed in other studied areas. Growth of fish is often affected by a number of environmental factors, including dissolved oxygen and pH value. Rustamyia sewage treatment plant on Diyala river caused contamination in the area. Water quality in Diyala river is considered very poor due to low dissolved oxygen (9) and low pH (10) values.

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معدلات النمو والهلاك لسمكتي الكارب العادي *Cyprinus carpio* والشلق *Aspius vorax* في نهر ديالى، جنوبي بغداد

عبد المطلب جاسم الرديني

الملخص

تم جمع 78 نموذجاً من اسماك الكارب العادي *Cyprinus carpio* و86 نموذجا من أسماك الشلق *Aspius vorax* في المنطقة الملوثة من نهر ديالى. درست معدلات النمو والوفيات باستخدام بعض القياسات الحياتية خلال المدة من شباط/2000 ولغاية كانون الثاني/2001. دلت قيم معامل الانحدار (b) للعلاقة بين الطول والوزن على ان النمو في هذين النوعين هي غير قياسية Allometric، اذ لوحظ ان الزيادة من وزن سمكة الكارب العادي اعلى منها في الزيادة في طول الجسم. بلغ معامل الحالة لسمكة الكارب العادي والشلق 1.02 و1.08 على التوالي. لوحظ سيادة المجموعات العمرية الثلاث الأولى للنوعين قيد الدراسة بنسبة 38.5 و27.9% على التوالي. بينما مثلت المجموعات العمرية للفئات العمرية 4 و5 سنة نسبة منخفضة (8.9 و12% على التوالي). بلغ أقصى طول افتراضي (L∞) يمكن ان تصل الية سمكة الكارب العادي 33.9سم بينما كان 45.7 سم لسمكة الشلق. وبلغ أقصى وزن افتراضي (W∞) يمكن ان تصل اليه كل من سمكة الكارب العادي والشلق 217 و827غم على التوالي. حسبت معدلات الوفيات الكلية (Z) لهذين النوعين اذ بلغت 2.8 و 2.96 على التوالي.

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