RELATIONSHIP BETWEEN WEIGHT AND MORTALITY RATIO OF COMMON CARP *CYPRINUSCARPIO*CULTIVATED IN FLOATING CAGES DURING ACUTE INCREASING OF TEMPERATURE

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ABSTRACT

Current study was conducted in 13 floating cages located in Shatt Al-Arab River bank at Al-Hartha District. Common carp *Cyprinuscarpio* of different weights (290-1700 gm) and numbers (400-1047) fish/cage was cultivated in these cages. Observation was also taken from earthen pond at the same location cultivated with common carp, silver carp *Hypophthalmichthys molitrix* and grass carp *Ctenopharyngodonidella*. Results showed that water temperature range between 30-35 ^{0}C during May-June, 2015 and a range of 36- 38 ^{0}C during July-August, 2015 in floating cages, while in earthen pond there were 1 ^{0}C more. Salinity don't differ too much during experiment and range between 1.5-3 ppt. Results of earthen pond revealed no fish mortality during experiment for three species cultivated in this pond. Results appeared that fish mortality during May-June don't largely differed and its ranged between 0.709%-1.861% and there weren't any relationship between fish mortality and fish weight. Different fish mortality during July-August which ranged between 3.88% for average fish weight of 400 g and total fish mass of 412 kg and 14.75% for average fish weight of 1700 g and total fish mass of 680 kg. Significant correlation (r=0.86) was found between average fish weight and fish mortality.Significant correlation (r=0.72) was also found between total fish weight and fish mortality. From previous results we concluded that there were positive relationship between fish mortality and fish weight during July-August.

INTRODUCTION

It is commonly accepted that thermal and trophic conditions of the environment play a crucial role in determining the growth, biomass accumulation, and, finally, the productivity in fish populations inhabiting fresh waters (1; 2; 3). At the present time, the studies into fish thermal tolerance gain considerable importance in view of the problem of environmental thermal pollution near the zones of discharge of heated waters from thermal and nuclear power plants and industrial enterprises (4; 5). Aquatic nuisance species are susceptible to temperatures that exceed their thermal tolerance, and there were two types of upper lethal thermal limits exist: acute upper lethal temperatures, and chronic or incipient upper lethal temperatures (6). Acute upper lethal temperatures are the temperatures at which death occurs when water temperature is raised rapidly. Chronic or incipient upper lethal thermal limits involve continuous exposure of the target organism to constant lethal temperatures for a time period long enough to achieve significant mortality. Under acute impact fish die within a few minutes or hours, while under chronic impacts mortality occurs for several days or weeks depending on the temperature of initial acclimation (5).

Physiological and metabolic processes of ectothermal animals are affected in any environment that is characterized by major and rapid temperature changes, and fishes can also experience rapid temperature changes when moving to different water depths, or slower changes with season, during which the acclimation time is longer (7; 8). Ambient temperature affects the speed of metabolic and physiological processes such as respiration, the immune system or growth (9; 10; 11). Temperature tolerance is dependent upon previous thermal history (12; 13).

Many researchers deal with lethal temperature for carp such as (14) who studied sensitivity of the pond carp to high temperature at early stages and(15) who studied upper lethal and rearing temperatures for juvenile common carp (*Cyprinuscarpio*) and silver carp (*Hypophthalmichthys molitrix*).(16) investigated lethal response of thermal shock for silver carp, bighead carp (*H. nobilis*), grass carp (*Ctenopharyngodonidella*) and common carp. (17) deal with influence of the water heating rate upon thermal tolerance in

common carp. No studies in Iraq dealing with lethal temperature of cultivated or wild fishes.

MATERIALS AND METHODS

Current study was conducted in 13 floating cages with dimensions of 3×4 meters and net depths was 3 meters (2 meters under water surface). These cages located in Shatt Al-Arab River bank at Al-Hartha District. Common carp of different fish weight (290-1700) g and differentnumbers (400-1047) fish/cage was cultivated in these cages. Observation was also taken from earthen pond of 10000 square meters at the same location. This pond was cultivated with six thousands common carp, five hundreds of silver carp and seven hundreds of grass carp. Floating cages fish were weighed at the first day of May and first day of July- 2015, while pond fish was weighed at 2-May,2015. Fish mortalities of floating cages and earthen pond was recorded during May to August, 2015. Fish were fed on artificial pelleted food during all months in earthen pond, while in floating cages feeding was stopped when mortalities increased largely. Surface water temperature was measured three times a week during experiment using simple thermometer, and salinity measured weekly by digital saline meter.

RESULTS

Results of measuring water temperature showed a range between 30-35 ^{0}C during May-June and a range of 36- 38 ^{0}C during July-August in floating cages, while in earthen pond there were 1 ^{0}C more. Salinity don't differ too much during experiment and range between 1.5-3 ppt. Results of earthen pond revealed no fish mortality during experiment for three species cultivated in this pond.

Detailed information was shown in table (1) about fish reared in floating cages during May-June. Results appeared that fish mortality during May-June don't largely differed and its ranged between 0.709% for average fish weight of 875 g and total fish weight of 617 kg and 1.861% for average fish weight of 290 g and total fish weight of 171 kg (figure 1 and 2). Correlation between average fish weight and fish mortality was – 0.40, while correlation between total fish weight and fish mortality was – 0.66. From

previous results we concluded that there weren't any relationship between fish mortality and fish weight during May-June.

Table (2) showed detailed information about fish reared in floating cages during July-August. Results appeared that fish mortality during July-August largely differed and its ranged between 3.88% for average fish weight of 400 g and total fish weight of 412 kg and 14.75% for average fish weight of 1700 g and total fish weight of 680 kg (figure 3 and 4). Significant correlation (r= 0.86) was found between average fish weight and fish mortality and also Significant correlation (r= 0.72) was found between total fish weight and fish mortality. From previous results we concluded that there were positive relationship between fish mortality and fish weight during July-August.

Table (1) Common carp mortalities during May-June, 2015 in thirteen floating cages.

Cage no.	Fish No.	Average fish weight (gm)	Total fish weight. (kg)	Mortality No.	Mortality ratio (%)
1	810	695	563	10	1.235
2	700	505	354	10	1.429
3	668	800	534	8	1.198
4	793	690	547	13	1.639
5	406	1300	528	6	1.478
6	708	1000	708	8	1.130
7	885	385	341	10	1.130
8	857	790	677	7	0.817
9	935	280	262	15	1.604
10	705	875	617	5	0.709
11	1047	310	325	17	1.624
12	1007	310	312	12	1.192
13	591	290	171	11	1.861

Table (2) Common carp mortalities during July and August, 2015 in thirteen floating cages.

Cage No.	Fish No.	Average fish weight (g)	Total fish weight. (kg)	Mortality No.	Mortality ratio%
1	800	850	680	97	12.12
2	690	650	449	40	5.80
3	660	1000	660	64	9.67
4	780	850	663	77	9.87
5	400	1700	680	59	14.75
6	700	1250	875	89	12.71
7	875	500	438	53	6.06
8	850	1000	850	95	11.18
9	920	400	368	57	6.20
10	700	1100	770	50	7.14
11	1030	400	412	40	3.88
12	995	400	398	62	6.23
13	580	400	232	31	5.34

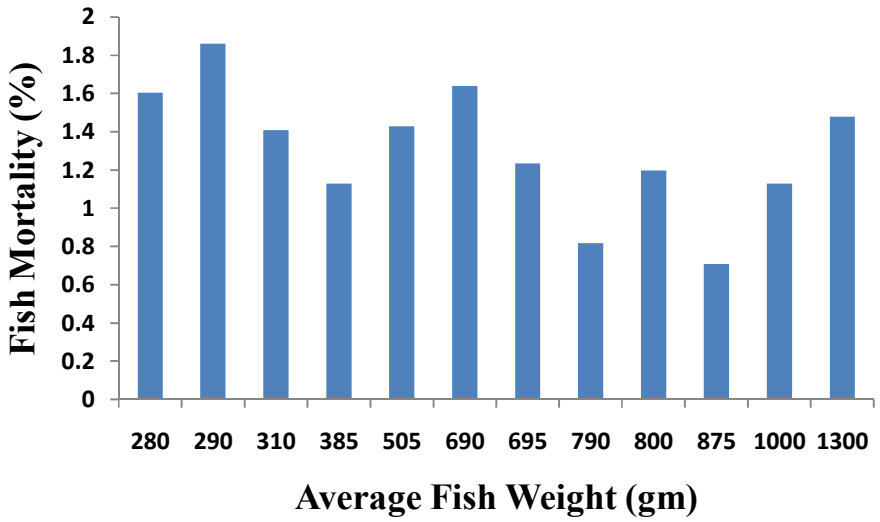

Figure (1) Fish mortality for common carp of different average fish weight during May and June, 2015.

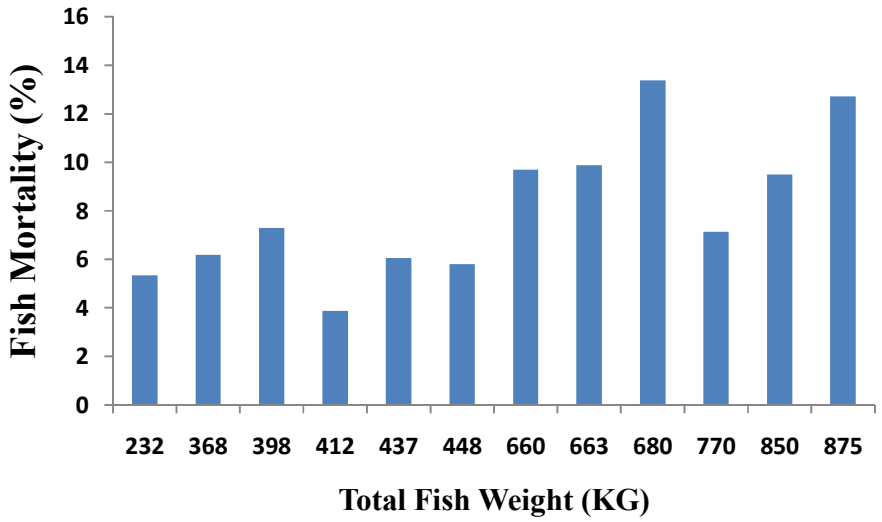

Figure (2) Fish mortality for common carp of different total fish weight during May and June, 2015.

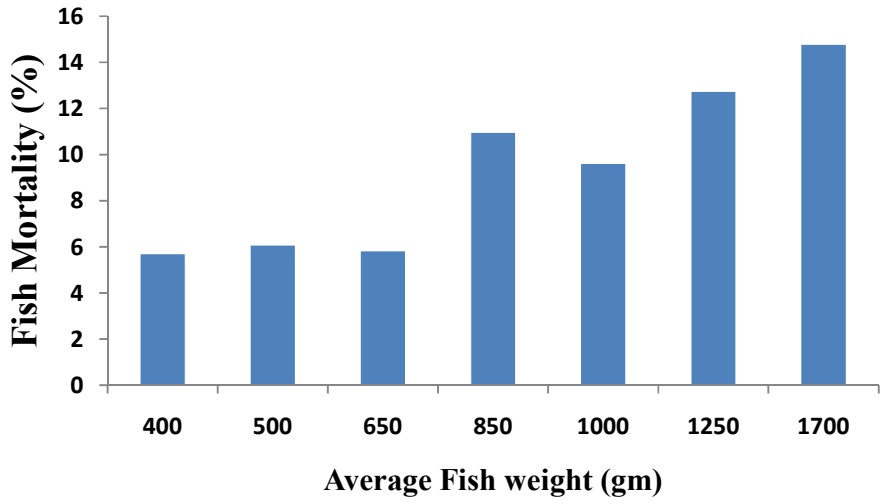

Figure (3) Fish mortality for common carp of different average fish weight during July and August, 2015.

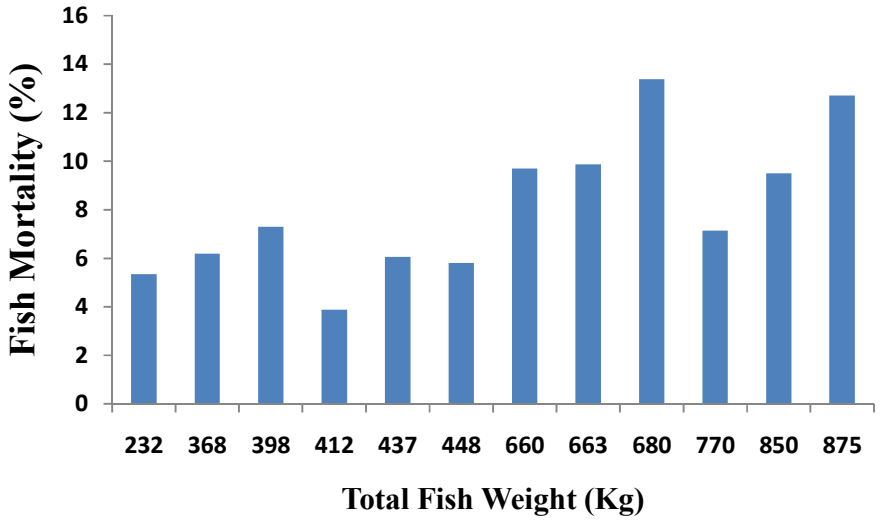

Figure (4) Fish mortality for common carp of different total fish weight during July and August, 2015.

DISCUSSION

The maximum temperature, which fish can withstand, varies from species to species, and within species according to the environmental history of the fish. Generally, fish can acclimate to gradually rising temperatures for some degree, so that the lethal temperature depends to some extent on the temperature to which the fish was initially acclimated. The ultimate upper incipient lethal temperature (UUILT) is the highest temperature to which fish can acclimate and therefore it is equal to the highest level of UILT (13). If fish are exposed to temperatures above their upper thermal tolerance limits their survival probability is time dependent and they are at their thermal resistance zone (18).

Results of current study in May and June of mortality ratio ranges between 0.709-1.861 may be attributed to natural mortalities that noticed also in these cages in all different months for five years of cultivation where water temperature never exceed 34 ^{0}c except at July and August, 2015. For previous reasons and notes, it was concluded that increasing of fish mortality at last two months attributed to very high water temperature

(36-38) ^{0}C. Despite of water temperature for earthen pond at these two months reached (36-39) ^{0}C, there weren't any fish died. This result may be attributed to low temperatures on the bottom or inside the clay of earthen pond, so fish will settled down on the bottom or may be borrow their body in the clay to avoid very high temperature of surface water. May be there were another reasons for these results such as low fish density in earthen pond comparing with cages and may be the stress of high water current in floating cages especially in high and low tide comparing with no current in earthen pond.

Results of current study revealed that UILT value for common carp was 36-38 ^{0}C. Nearly the same results were achieved by(16) whom pointed that the UUILT values of silver carp, bighead carp, grass carp and common carp at 34 or 35^{0}C acclimation temperature were 36.6℃, 35.1℃, 37.2℃ and 36.8℃, respectively. Larval common carp can survive and continue to feed at 36° C, but most will die at 38^{0}C (14). Temperatures equal and more than 38 °C are lethal for juveniles of carp (19). In all seasons the highest ULT values (ranging from 38.2 to 41.3^{0}C) in young common carp were observed when the chronic lethal method is used at the average water heating rate of 0.04^{0}C/h (17).Results of current study appeared positive relationship between mortality ratio and fish weight. This result may be attributed to larger relative gill area in small fishes because of its high metabolic rate comparing with large fishes (20; 21; 22).Relative gill area estimated on the basis of fish weight decrease with increasing fish total length.

علاقة الوزن مع نسب بقاء اسماك الكارب الشائع*Cyprinuscarpio*المستزرعة في الاقفاص العائمة عند الارتفاع الحاد لدرجات الحرارة

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الخلاصة

أجريت الدراسة الحالية في ١٣ قفص عائم منصوبة في ضفة شط العرب عند ناحية الهارثة، إذ استزرع فيها اسماك الكارب الشائع *Cyprinuscarpio* بمعدلات اوزان مختلفة (290-1700) غم واعداد مختلفة (1047-400). اخذت الملاحظات ايضا من حوض ترابي في نفس المنطقة مستزرع فيهثلاثة انواع من الاسماك وهي الكارب الشائع والكاربالفضي (*Hypophthalmichthys molitrix*) والكارب العشبي (*Ctenopharyngodonidella*).أظهرت النتائج ان درجات الحرارة في الاقفاص تراوحت بين ٣٠-٣٥ درجة مئوية اثناء أيار- حزيران ٢٠١٥، وتراوحت بين ٣٦-٣٨ درجة مئوية اثناء تموز- آب ٢٠١٥، بينما كانت درجة الحرارة في الحوض الترابي تزيد ١ درجة مئوية عن حرارة شط العرب. لم تختلف ملوحة المياه كثيرا خلال فترة التجربة وتراوحت بين ١.٥-٣.٠ جزء بالألف جزء. بينت النتائج عدم وجود اي هلاكات في انواع الاسماك الثلاثة المربات في الحوض الترابي. لم تختلف هلاكات الاسماك كثيرا في الاقفاص العائمة للفترة أيار- حزيران وتراوحت بين ٠.٧٠٩-١.٨٦١% ولم توجد اي علاقة بينها وبين وزن الاسماك، في حين اختلفت نسبة الهلاكات بشكل كبير للفترة تموز- آب وتراوحت بين ٣.٨٨% للأسماك التي معدل وزنها ٤٠٠ غم ووزنها الكلي ٤١٢ كغم وبين ١٤.٧٥% للأسماك التي معدل وزنها ١٧٠٠ غم ووزنها الكلي ٦٨٠ كغم. وجد ارتباط معنوي (r= 0.86) بين معدل وزن الاسماك ونسبة الهلاكات وكذلك ارتباط معنوي (r= 0.72) بين الوزن الكلي للأسماك ونسبة الهلاكات. من نتائج التجربة الحالية يمكن الاستنتاج بوجود علاقة طردية بين وزن الاسماك ونسبة الهلاكات للفترة تموز- آب.

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