World Journal of Fish and Marine Sciences 5 (4): 392-397, 2013
ISSN 2078-4589

DOI: 10.5829/idosi.wjfms.2013.05.04.7379

Determination of Some Biometry and Fecundity Indicators in Female Khramulia (*Capoeta capoeta gracilis*, Keyserling 1861) in the Sefidroud River

[1]*Ali Khodadoust,* [1]*Majid Rasta,* [2]*Hossein Khara and* [1]*Mina Rahbar*

[1]Young Researchers Club, Islamic Azad University, Lahijan Branch, Iran
[2]Department of Fishery and Aquaculture, Faculty of Natural Resource, Islamic Azad University Lahijan Branch, Lahijan, Iran

Abstract: Khramulia (*Capoeta capoeta gracilis*) is one of the semi economically valuable fishes in the rivers. This fish is a potamodoromous and spawning in rivers. The study of fecundity and biometry are one of the important indicators in reproduction and biology of fishes. The present study was conducted in the spring of 2010 on 36 Khramulia specimens caught from each of 2, 3 and 4 years fishes, in the Sefidroud River to investigate fecundity and biometry in this species. According to results, mean of total length was 195.5± 22.13 mm (152-256 mm), mean of fork length was 182.19± 20.98 mm (144-238 mm), mean of standard length was 168.38 ± 19.62 mm (130-220 mm), mean of weight 85.11 g (40.1-165.3), mean of gonad weight 2.23±0.98 g (0.52-4.60 g), mean of absolute fecundity 1572.60± 759.38 eggs (605.55-3901.28 eggs), mean of relative fecundity 19.51± 9.68 (8.77-57.27), mean of egg number 77.74± 38.82g (22.6-263.7g), mean of egg diameter 1.16 mm (0.98-2.23 mm) and Gonadosomatic index (GSI) 2.63% (0.9-4.9%). Maximum mean of absolute fecundity (2355.27 ± 699.64 eggs) belonged to 4-year specimens and maximum mean of relative fecundity (22.5± 12.9) belonged to 2-year specimens. Among different age groups of fish there were significant differences in mean of total length, fork length, standard length, weight, gonad weight, egg number, absolute fecundity and relative fecundity ($p \leq 0.05$). While it wasn't significant difference egg diameter and Gonadosomatic index among these female broods ($P>0.05$).

Key words: Sefidroud river · *Capoeta capoeta gracilis* · Female broods · Biometry · Fecundity

INTRODUCTION

Today, the need to protein materials and food materials shortages matter to society and be an important part of the economic, human research and technological ability spend to review, study and implementation of projects in this field. Among suitable production of natural resources has important role and it is effective for continuation of this process.

Rivers are part of water ecosystems and site of many freshwater fish that they permanently live in it or marine fish temporarily survive period of life, due to sexual physiological changes and returned back into the sea after spawning. Generally, study of environment and lifestyle of fish in rivers can be utilized to create the necessary conditions for increasing stocks and also provide reproduction and culture of them with biotechnological reviews.

Reviews of fish in ecosystems is important, due to of evolutionary, ecological, behavioral biology, protection of their, management of water resource and exploitation of fish resources [1, 2].

With growing pressures due to growth of population on current limited resources, it is felt an urgent need to better understand the characteristics of the aquatics and their environment. Also it is important to correct management of understanding the biology and have of adequate information about the aquatics [3]. Several factors including season, temperature, social circumstance, age, genetics [4], physiology and biochemical status of fish [5] and other variables related to reproductive capacity and opportunity. Environmental factors also influencing developing of gonad and reproduction behavior [6]. Also, dietary including some material such as 17β-estradiol affect on serum sex hormones, gamete quality and gonadal sex differentiation.

Corresponding Author: Ali Khodadoust, Young Researchers Club, Islamic Azad University, Lahijan Branch, Iran. P.O. Box: 1616.

Serum levels of estradiol and 17-hydroxyprogestrone were high in 17β-estradiol-treated fish compared to the control group in *Carassius auratus* [7]. 17β-estradiol is capable to induce a complete masculinization of genetic females at a low dosage level in *Astatotilapia latifasciata* [8].

Khramulia (*Capoeta capoeta gracilis*) is one of the semi economically valuable fishes in the Caspian Sea basin. Several studies applied on the characteristics of the ecology and biology of Khramulia [9-14]. Sefidroud River is one of breeding areas for most species of Caspian Sea fish, including carp [15].

With respect to, it is not possible that estimated number of larvae hatched from eggs and egg viability in the natural environment, fecundity estimate generation and situation of eggs in future [16]. Therefore, we examined biological characteristics, absolute fecundity, relative fecundity and Gonadosomatic index of Khramulia in Sefidroud River in 2010.

MATERIALS AND METHODS

Sampling of fish was taken in May until June 2010. Catch of 36 Khramulia were done at different locations of Sefidroud River. Then fish transported to the laboratory and body weight, total length, fork length, standard length and gonad weight were measured and recorded accurately [3]. Reading scales were used to determine the age of fish [17].

Scales pick from middle part of the body, between dorsal fin and lateral line and for the detection of concentric circles on scales was used binocular loop.

To determine fecundity, study applied on fish in the fourth stage of gonads growth (before of spawning). For this purpose, abdominal cavity incises and emits gonads. Then, number of eggs takes from first, middle and end of ovarian. Eggs were strewing in formalin 4% for fixing and strengthen [18]. The eggs were carefully counted and absolute fecundity was earned with weighted method and the equation 1 [19]:

$$AF = \frac{nG}{g} \tag{1}$$

AF : Absolute fecundity
n : Number of eggs in the sample
G : Ovarian weight
g : Weight of sample

After calculation of absolute fecundity, relative fecundity was determined according to equation 2 [19]:

$$RF = \frac{AF}{Tw}$$

RF : Relative fecundity
AF : Absolute fecundity
Tw : Body weight

Gonadosomatic index (GSI) is an indirect method for estimate spawning season of species. Equation 3 was used to determine Gonadosomatic index [19]:

$$\text{Gonadosomatic Index } \frac{\text{Gonad weight}}{\text{Total body weight}} \times 100 \tag{3}$$

Data were analyzed by SPSS 16 software and ANOVA, T-test and Tukey (for normal data), nonparametric tests of Kruskal-Wallis and Mann-Whitney (for non-normal data) in significant level 95%. Graphs were drawn by 2003 Excel software.

RESULTS

The Obtained Results of Biometry in Female Fishes Are Presented in Table 1 and 2: The total length, fork length and standard length of Khramulia female fishes had significant differences among different ages based on Kruskal-Wallis test ($P<0.05$). Mann-Whitney test showed that total length of Khramulia female fishes have significant differences among the following ages.

(2-year fishes, 3-year fishes) (2-year fishes, 4-year fishes) (3-year fishes, 4-year fishes).

The gonad weight, egg number in each gram, absolute fecundity and relative fecundity of Khramulia female fishes had significant differences among different ages based on Kruskal-Wallis test ($P<0.05$). Tukey test showed that gonad weight and absolute fecundity of Khramulia female fishes have significant difference between the following ages.

(2-year fishes, 4-year fishes) (3-year fishes, 4-year fishes).

Mann-Whitney test indicated that relative fecundity of Khramulia female fishes have significant difference between the following ages.

(2-year fishes, 3-year fishes) (3-year fishes, 4-year fishes).

Tukey test showed that egg number in each gram of Khramulia female fishes have significant difference between the following ages.

(2-year fishes, 3-year fishes).

According to the ANOVA test, egg diameter hasn't significant differences among different ages of Khramulia female fishes ($P>0.05$). Also, According to the Kruskal-Wallis test, Gonadosomatic index hasn't significant differences among different ages of Khramulia female fishes ($P>0.05$).

Table 1: Biometry of female fishes in the Sefidroud River at reproduction season of 2010

			Range of changes	
Parameters	Age & number of fish	Mean ± SD	Minimum	Maximum
Total length (mm)	2-year fishes= 12	176.33 ± 11.32	152	189
	3-year fishes= 15	194.27 ± 13.9	158	210
	4-year fishes= 9	223.11± 14.74	207	256
	Total mean= 36	195.5 ± 22.13	152	256
Fork length (mm)	2-year fishes= 12	164.08± 10.15	144	177
	3-year fishes= 15	180.73 ± 13.44	147	199
	4-year fishes= 9	208.78 ± 13.32	192	238
	Total mean= 36	182.19± 20.98	144	238
Standard length (mm)	2-year fishes= 12	151.67 ± 10.13	130	165
	3-year fishes= 15	166.8± 12.59	135	185
	4-year fishes= 9	193.33 ± 11.91	180	220
	Total mean= 36	168.38± 19.567	130	220
Weight (g)	2-year fishes= 12	57.35 ± 9.53	40.1	69.5
	3-year fishes= 15	81.22± 15.77	46.5	108.6
	4-year fishes= 9	128.64 ± 16.88	112.6	165.3
	Total mean= 36	85.11± 30.75	40.1	165.3

Table 2: Fecundity of female fishes in the Sefidroud River at reproduction season of 2010

			Range of changes	
Parameters	Age & number of fish	Mean ± SD	Minimum	Maximum
Gonad weight (g)	2-year fishes= 12	1.53 ± 0.64 ^{ab}	0.428	2.999
	3-year fishes= 15	2.19 ± 0.77 ^{ab}	0.875	4.426
	4-year fishes= 9	3.233± 1.536 ^{c}	1.698	6.601
	Total mean= 36	2.23 ± 0.98	0.428	6.601
Egg number in each gram	2-year fishes= 12	97.93± 55.8 ^{ac}	53.9	263.7
	3-year fishes= 15	59.65 ± 22.58 ^{bc}	22.6	96.9
	4-year fishes= 9	76.99 ± 14.149 ^{abc}	55.3	91.4
	Total mean= 36	76.74± 38.82	22.6	263.7
Egg diameter (mm)	2-year fishes= 12	1.08 ± 0.17	0.77	1.3
	3-year fishes= 15	1.25± 0.25	0.83	1.86
	4-year fishes= 9	1.13 ± 0.16	0.87	1.46
	Total mean= 36	1.161± 0.21	0.77	1.86
Absolute fecundity	2-year fishes= 12	1459.51 ± 760.72 ^{ab}	631.97	3596.97
	3-year fishes= 15	1193.47± 385.36 ^{ab}	605.55	1888.07
	4-year fishes= 9	2355.27 ± 699.64 ^{c}	1675.56	3901.28
	Total mean= 36	1572.604± 759.38	605.55	3901.28
Relative fecundity	2-year fishes= 12	25.5 ± 12.09	12.04	57.27
	3-year fishes= 15	15.58 ± 8.05	8.77	40.6
	4-year fishes= 9	18.08± 3.37	13.31	23.59
	Total mean= 36	19.011 ± 9.68	8.77	57.27
Gonadosomatic index	2-year fishes= 12	2.6	1.25	4.55
	3-year fishes= 15	2.78	0.9	4.9
	4-year fishes= 9	2.45	1.65	3.5
	Total mean= 36	2.63	0.9	4.9

DISCUSSION

Efficient uses from water resources require knowing components of an ecosystem, that this information can't be possible except with investigation and study of biology characterization and fish ecology [3, 17].

The biological study of different fishes is due to keep and rebuild of their stocks in a water ecosystem and in this way, all of economic and noneconomic fishes have great importance and value due to their role in water ecosystems. Hence, improve of broodstock quality and reproduction control, can to help us for achieve to aquaculture growing and developing request in the world as most important reflections of modern bio-technology [20].

Generally, most cyprinids mature in length of less than 300 millimeter [21]. This study showed that the highest and the lowest length in female Khramulia were related to 4-years fishes (223.11± 14.74 mm) and 2-years fishes (176.33± 11.32 mm).

Most bony fish, especially cyprinids spawn in spring and after the first maturation each year. For example, each year spawn of *Rutilus frisii kutum* in the Caspian Sea and Chinese cyprinids in the reproduction and breeding institutes. In this fishes, gametogenesis occurs in autumn and spawns in spring and summer [22] and temperature is stimulant of spawning in this species [17].

Absolute fecundity increases with increasing the fish length [23-25, 17], but it has wide range in length groups. There are a linear graph for relationship between fecundity and weight of fish [26-31] and fecundity has more dependence with weight than length [32, 33]. However, weigh has less benefit than length [34]. Also, weight change with approach spawning season. Typically, ratio weight with length is cube [29, 30].

In general, there is a direct relationship between absolute fecundity and length and in this study, 4-years fishes had the highest fecundity and absolute fecundity increased in higher ages, these results were similar to other fish species like researches on *Rutilus frisii kutum* [35] and *Alburnus chalcoides* [36]. While relative fecundity has relatively inverse ratio with length and weight [1]. According to previous study on *Rutilus frisii kutum* [35], there is relatively weak correlation between relative fecundity and weight. Therefore, relative fecundity decreases with increasing the weight.

The results showed that the highest egg number in each gram between different ages is in 2-years fishes. 2-years fishes had smaller eggs, then, they have the highest of egg number in each gram. Also, similar previous results were recorded on *Rutilus frisii kutum* [35], *Oncorhynchus mykiss* [37] and *Alburnus chalcoides* [38]. Ovarian weight is determined by the number of eggs present in the ovary and fecundity increases with increasing ovary weight [39-41]. Similar results were obtained in this study so that the maximum mean of ovary weight and absolute fecundity related to 4-years fishes. The study on *Rutilus frisii kutum* [42] showed that absolute fecundity increased with increasing length and weight and similar results were obtained in this study, so that 4-years fishes had the highest fecundity with increasing length and weight.

The results showed that maximum mean of Gonadosomatic index was 2.78 and minimum mean of Gonadosomatic index was 2.45 in female fishes.

Fecundity of *Capoeta capoeta umbla* obtained 3754 to 35859 eggs per fish in Gharesou River of Turkey [43]. Also, fecundity of this fish was 9452 eggs per female in Lake of Kockpru Dam in Turkey [44]. Absolute fecundity Mean of Khramulia was 3970 in the Golestan National Park River [45]. Absolute fecundity Mean of Khramulia was 8204.8 in the Lake of Maku Dam [46]. Absolute fecundity Mean of Khramulia was determined 3116 in the Madarsou creek of Golestan National Park [13]. Fecundity of Khramulia was 1823 to 9274 (with mean 4553.8) in the Sefidroud River and 2028 to 17097 (with mean 6956.45) in the Ghezel Ozan River [14]. Fecundity of Khramulia was 605 to 3901 (with mean 1572.60) in this study.

ACKNOWLEDGEMENTS

The authors express their sincere appreciation to the people who gave their time, advice and support to this study, including: Mr. Ali Nia, responsible of Fisheries laboratory in Islamic Azad University of Lahijan Branch and Mr. Mahi Sefat, expert of inland waters aquaculture Institute.

REFERENCES

1. Rajabi Nejad, R., 2001. Study of growth, feeding and reproduction of (*Alburnus chalcoides*, Guldenstaedt 1772) in the Sefidroud River. Master thesis of Fisheries, Islamic Azad University of Lahijan, Iran.
2. Kouh Nejad, A. and P. Azarpour, 2003. Morphometric and meristic studies on *Alburnus chalcoides* migrant to Chamkhaleh River of Langroud. Project of Bachelor of Fisheries, Islamic Azad University of Lahijan, Iran.
3. Vosoughi, G.M. and B. Mostajir, 1992. Fishes of freshwater. Tehran University Publication, Iran.
4. Yousefian, M. and F. Laloei, 2011. Genetic Variations and Structure of Common Carp (*Cyprinus carpio*) Populations by Use of Biochemical, Mitochondrial and Microsatellite Markers. Middle-East Journal of Scientific Research, 7(3): 339-345.
5. Yousefian, M., M. Sheikholeslami Amiri, M. Hedayatifard, A.A. Dehpour, H. Fazli, M. Ghiaci, S.V. Farabi and S.H. Najafpour, 2010. Serum Biochemical Parameter of Male and Female Rainbow Trout (*Onchorhynchus mykiss*) cultured in Haraz River, Iran. World Journal of Fish and Marine Sciences, 2(6): 513-518.

6. Yousefian, M., 2011. Environmental factors influencing on migratory behavior of *Rutilus frisii kutum* in Shiroud River. World Applied Sciences Journal, 13(7): 1572-1579.
7. Tarkhani, R., M.R. Imanpoor and V. Taghizadeh, 2012. Effect of Dietary 17β-estradiol on Serum Sex Hormones Levels and Gamete Quality in Goldfish (*Carassius auratus*). World Journal of Fish and Marine Sciences, 4(6): 637-644.
8. Yousefian, M., A. Osia Laghab, E. ahmadi, M. Irani and C. Makhdoomi, 2012. Effect of Different Administration of 17β-estradiol on Gonadal Sex Differentiation in *Astatotilapia latifasciata*. World Applied Sciences Journal, 18(7): 868-872.
9. Mokhayer, B., B. Hassanzadeh Kiabi and S. Kohestan Eskandari, 2000. Study of Tracheliastis and Acanthocephalorncoides in Khramulia of Golestan National Park River. Iranian Journal of Veterinary Research (Tehran University), 2: 66-65.
10. Kohestan Eskandari, S., 2003. Study on population of Khramulia (*Capoeta capoeta gracilis*) in Madarsou Creek. Iranian Journal of Marine Science and Technology, 2&3: 11-20.
11. Sayad Borani, M. and D. Ghani Nejad, 2004. Assessment of stocks of Khramulia (*Capoeta capoeta*) in Lake Maku Dam. Iranian Journal of Fisheries, 3: 115-128.
12. Rezaei, M., A. Kamali, B. Hassanzadeh Kiabi and A. Shabani, 2007. The effect of the flood of 2001, 2002 and flow speed of water on Khramulia (*Capoeta capoeta gracilis*) in the Madarsou Creek of Golestan National Park. Iranian Journal of Marine Science and Technology, 1&2: 56-47.
13. Rezaei, M., A. Kamali, B. Hassanzadeh Kiabi and A. Shabani, 2007. Study of age, growth and reproduction of Khramulia (*Capoeta capoeta gracilis*) in the Madarsou Creek of Golestan National Park Compared with previous studies of 2001. Iranian Journal of Fisheries, 2: 74-63.
14. Moradi Chafi, M., 2009. Study of Some biological characteristics of Khramulia in the Ghezel Ozan River. Master thesis, Islamic Azad University of Lahijan, Iran.
15. Abbasi, K., A. Valipour, D. Haghighi, A. Sarpanah and S.A. Nezami, 1999. Fishes of Guilan. Guilan Fisheries Research Center, pp: 113.
16. Pitcher, T.J. and P.J.B. Hart, 1996. Fisheries Ecology. Chapman and Hall, London.
17. Nikolsky, G.V., 1963. The Ecology of fishes. Academic Press, London, pp: 350.
18. Azeri Takami, G., 1979. Determine of fecundity in Southern Caspian kutum (*Rutilus frisii kutum*). Master's thesis, University of Tehran, Faculty of Veterinary, Tehran, Iran.
19. Biswass, S.P., 1993. Manual of method in fish biology. South Asian Publisher publications Limited.
20. Vladi, T.V., B.A. Afzelius and G.E. Bronnikov, 2002. Sperm Quality as Reflected Through Morphology in Salmon Alternative Life Histories. Biology of Reproduction. Department of Zoology, Stockholm University, pp: 91-106.
21. Winfield, I.J. and J.S. Nelson, 1991. Cyprinid Fishes systematic, Biology and Exploitation, Chapman and Hall, pp: 667.
22. Wootton, R.J., 1995. Ecology of teleost fishes, Champan Hall, pp: 404.
23. Franz, V., 1910. Die Eiproduktion der Scholle (*Pleuronectes platessa*). Nachtrage Wiss. Merasunters, 1.
24. Kisselewitch, K.A., 1923. Materials on the biology of the Caspian herrings I. The fertility of the Wolga Caspain herrings. Astrakhan Ichthy. Lab. Rep., 5(1).
25. Clark, F.N., 1934. Maturity of the California Sardine (*Sardina caeruled*), determined by ova diameter measurement. Fish. Bull. Sacramento, pp: 42.
26. Bagenal, T.B., 1957. The breeding and fecundity of the long rough dab, *Hippoglossoides platessoides* and the associated cycle in Condition. J. Mar. boil. Ass. U.K, 36: 339-375.
27. Pillay, T.V.R., 1958. Biology of the hilsa, *Hilsa illisha* (Ham) of the River Hooghly. Indian J. Fish, pp: 5.
28. Kandler, R., 1959. Uber die Fruchtbarkeit der scholle im Kattegat. Keiler Meeresforsch, pp: 13.
29. Baxter, I.G., 1959. Fecundities of winter-spring and summer-autumn herring spawners. J. Cons. Perm. Explor. Mer, 25: 73-80.
30. Bridger, J.P., 1961. Study on the fecundity and larval abundance of Downs herring. Fishery Invest. Lond. Ser., 2: 23.
31. Varghese, T.J., 1973. The fecundity of *Labeo rohita*. Proc. Indian Acad. Sci., 77(5): 214-224.
32. Manooch, C.S., 1976. Reproductive cycle, fecundity and sex ratios of the Red Poggy*, Pagrus pagrus* (Pisces: Sparidae) in North Carolina, Fishery Bulletin, 74(4): 775-781.
33. Smith, O.R., 1947. Returns from natural spawning of cutthroat trout and eastern book trout. Trans. Am. Fish. Soc., 74: 281-296.
34. Bagenal, T.B., 1967. A short review of fish fecundity, in the biological basis of freshwater fish production, Ed. Gerking S.D., Blackwell Scientific, Oxford.

35. Alijanpour, N. and S.Z. Fallah Shamsi, 2008. Effects of age, egg diameter, egg color, fish length, fish weight, time and temperature of water on fecundity and fertilization percent of female Southern Caspian kutum (*Rutilus frisii kutum*) migrant to Shiroud River. Project of Bachelor of Fisheries, Islamic Azad University of Lahijan, Iran.
36. Rahbar, M., S.A. Nezami, H. Khara and M. Rezvani, 2009. Determine the relationship of female broodstocks age with effective factors in artificial reproduction of Caspian salmon (*Salmo trutta caspious*, Kessler 1877). Iranian Journal of Fisheries of Azadshahr, 4: 99-104.
37. Shamspour, S., S.A. Nezami, H. Khara and H. Golshahi, 2008. Effect of age on reproductive performance of female rainbow trout broodstocks (*Oncorhynchus mykiss*). Iranian Journal Science Biology, 2: 73-81.
38. Rahbar, M., H. Khara, M. Ahmadnejad, M. Samadi, A. Khodadoust, R. Movahed and M.R. Hayat Bakhsh, 2008. Determine the some indicators of fecundity in (*Alburnus chalcoides,* Guldenstaedt 1772) migrant to Anzali wetland. Iranian Journal of Fisheries Research of Lahijan, 2: 53-59.
39. Varghese, T.J., 1980. The fecundity of *Coilla dussumieri*. Proc. Indian Nat. Sci. Acad., 45(1): 114-119.
40. Bhatnagar, G.K., 1964. Observations on the spawning frequency and fecundity of certain Bhakra reservoir fishes. Indian J. Fish., 11(1): 485-502.
41. Bagenal, T.B., 1963. The fecundity of Witches in the Firth of Clyde, J. Mar. bicl. Ass. U.K., 43: 401-407.
42. Razavi Sayad, B., 1995. Study on Southern Caspian kutum (*Rutilus frisii kutum*). Fisheries Research Institute of Iran, pp: 164.
43. Turkmen, M., O. Erdogan, A. Yildirim and I. Akyurt, 1996. Reproduction tactics, age and growth of (*Capoeta capoeta umbla*, Heckle 1843). From the Askale Region of the Karasu River, Turkey. Fisheries Research, 54: 317-328.
44. Elp, M. and M. Karabatak, 2007. Study on *Capoeta capoeta* (Guldenstaedt, 1772) population living in kockopru Dam Lake. Van-Turkey. Journal of Applied Biological Sciences, 1(2): 57-61.
45. Kohestan Eskandari, S., 1998. Study of some characteristics of biology, ecology and parasitology in the Golestan National Park Rivers. University of Tarbiat Modares, Faculty of Natural Resources and Marine Sciences, Nour, Iran.
46. Abbasi Ranjbar, K., 1999. Study of fish of Lake Maku Dam. Culture and aquaculture department of fisheries of Iran, Tehran, pp: 69.