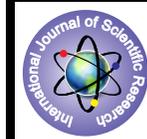


Evaluation of Reproductive Performance and Morphometric Parameters of Goldfish, (*Carassius Auratus*)



Zoology

KEYWORDS : Goldfish, fecundity, egg diameter, Marthwada

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ABSTRACT

In the present work evaluated the reproductive performance of goldfish, Carassius auratus relation with morphometric parameters and climatic conditions. Study was carried during the periods from December, 2012 to April, 2013. Goldfish females standard length (17 ± 1.41 cm) and total weight (23 ± 5.36 g). Gonad weight ranged between (1.50 - 4 g), absolute fecundity (1500-2900), relative fecundity (96.66 - 107.14), GSI% (9.52 - 13.13) and egg diameter (380 - 430 μ) were observed.

INTRODUCTION

Ornamental fishes are in greater demand due to their easy maintenance in houses, offices and commercial centers. Rearing of ornamental fish became a necessity not a luxury. Ornamental fishes are assuming importance in recent days as stress removers.

Goldfish, *Carassius auratus* (Linnaeus) one of the best aquarium fish world wide is native of central Europe. It was introduced into the Ooty Lake in Madras in 1874 from Central Europe for the experimental purpose. Goldfish is good model for conducting basic research work in laboratory conditions. In addition to its aesthetical characteristics goldfish acquired relatively recent interest as a biocontrol agent for mosquitoes in shallow ponds and pools because of its strong larvivorous nature of feeding (Gupta and Banerjee 2009). Ornamental fish producers need to know the time of initial maturity, and the period of fecundity of the most important commercial species to predict their reproduction.

No reference work is available on the reproductive biology of goldfish, in Marathwada region considering different climatic conditions, relationship between morphometric parameters and reproduction. In view of this in the present work attempts were made to study the reproductive parameters with relation to morphometric parameters and local climatic conditions. This is the first hand report from Marathwada region, Maharashtra, India.

MATERIALS AND METHODS

Approximately 2 months old juveniles goldfish, were purchased from market. Glass aquaria (90 × 30 × 36 cm) were used in this experiment. An aerator was provided in a aquarium. Water parameters were studied as per the procedures described in the standard methods (APHA 1981).

They were fed daily with artificial fish pellets and live tubifex worms / mosquito larvae at the rate of 10% of their body weight. Total weight and the standard length of fishes measured, fishes dissected and their ovaries removed and weighed. The spawning period were estimated from the development of gonads using Gonado-Somatic Index (GSI) and variation in egg diameters of samples (Lagler 1966).

Absolute fecundity (AF) studied by the gravimetric method. Relative fecundity (RF) obtained from the equation: $RF = AF / TW$. The diameters of eggs were measured with object micrometer.

In addition, statistical relationships between standard length (SL), body weight (TW), gonad weight (GW), absolute fecundity (AF), relative fecundity (RF) and egg diameter (Ed) calculated using the formula. The sexual maturity by method of (Nikolsky 1963). The gonads were weighed the ripe ova were counted one by one using a magnifying glass.

RESULTS AND DISCUSSION

The results of the present study indicate a gradual and steady in-

crease in GSI values in female goldfish, from December (10.71) onward until it reach maximum (13.13) during February and declined March (11.92) onwards in April (9.52)

Table 1. Some morphometric and reproductive parameters of female goldfish, *Carassius auratus*.

Months	SL (cm)	TW (g)	GW (g)	GSI (%)	AF	RF	Ed (μ)	Nikolsky Scale
December	19	14	1.50	10.71	1500	107.14	405	2
January	16	24	2.89	12.04	2332	97.16	385	4
February	15	30	4	13.13	2900	96.66	430	5
March	17	26	3.1	11.92	2518	96.84	402	3
April	18	21	2	9.52	2100	100	380	1
Mean	17	23	2.698	11.46	2270	99.56	400.4	
S.D.	1.41	5.36	0.87	1.23	465.62	3.98	17.62	

This demonstrates clearly that December represents the beginning of the spawning season of this species in captivity.

A significant positive relationship was noticed between total weight and absolute fecundity, gonad weight and absolute fecundity and total weight and gonad weight ($r = 0.999, 0.970$ and 0.967 respectively, $P < 0.05$). Egg diameters increased steadily from December to February then decreased

Table 2. The statistical relationships between various morphometric and reproductive parameters of female goldfish, *Carassius auratus*.

Relationship		Value of r	Significance of r at 5% and 1% levels
Ordinate	Abscissa		
SL	AF	-0.920	NS
TW	AF	0.999	Significant
RF	AF	-0.923	NS
GW	AF	0.970	Significant
GW	RF	-0.846	NS
SL	GW	-0.953	NS
TW	GW	0.967	Significant
SL	ED	-0.441	NS
TW	ED	0.414	NS
GW	ED	0.583	NS
AF	ED	0.430	NS

NS: Not significant.

Correlation coefficient values were also very high and significant in some relationships. The strongest calculated correlation coefficient ($r = 0.999$) was between TW and AF and the weakest one ($r = 0.414$) was between TW and ED they were highly significant in the statistical analysis ($P < 0.05$).

The results of the present study also indicate that a gradual and steady increase in GSI values in male goldfish, from December (2.5) onward until it reach its maximum (6.4) during February and declined March (3.75) onwards in April (3.61)

Table 3. Gonadosomatic index of male goldfish, *Carassius auratus*.

Months	FW (g)	SL (cm)	GW (g)	GSI (%)	Nikolsky scale
December	16	10	0.40	2.5	1
January	22	14	0.70	3.18	2
February	12.50	12	0.80	6.4	5
March	20	13	0.75	3.75	4
April	18	12	0.65	3.61	3
Mean	17.7	12.2	0.66	3.88	
S.D.	3.28	1.32	0.13	1.32	

Water parameters ranges between temperature 18-34 0C, pH 8-10, dissolved oxygen 2.5-10 (mg/L), TDS 500-700 (mg/L), TS 1900-2300 (mg/L) and TSS 2400-3000 (mg/L).

Goldfish reached initial sexual maturity in between 9 months to 1 year of age with a fish weight between 14 to 30 g, gonad weight of 1.50 to 4 g, and a gonadosomatic index of 9.52 to 13.13, according to the Nikolsky scale.

At initial sexual maturity, goldfish reached a mean gonad weight of 2.698g, fish weight of 23 g, absolute fecundity of 2270 ova per gonad. The maximum absolute fecundity was of 2900 ova per gonad (Table 1).

Martty and Couto (1973) mentioned that goldfish developed well at temperatures between 18 and 25 0C. In our study the temperature range observed between 18 and 34 0C.

Maturity was reached between 270 and 365 days old in the present study. The initial sexual maturity gives to the ornamental fish producers the days when fish starts to be mature.

The GSI is widely used by the biologists to indicate the maturity and periodicity of spawning and predicting the breeding season of the fish (Alam and Pathak 2010). The results demonstrated in (Table 1) about GSI values are compatible with those reported by other authors (Al-Noor 2010). Variation in the fecundity among fishes of the same and different species is very common, Nikolsky. This agrees with results of the present study about absolute and relative fecundity and their relationship with gonad weight.

One of the most important parameters used to determinate the reproductive potential of fish is the variation of egg diameter in fish ovaries. The larger egg size could result in better survival of larvae and fries and this eventually may be reflects on the success of the complete reproductive process (Blaxter 1988 and Lo et al 2009).

Statistical relationships of fish reproductive parameters are so important for understanding the general and seasonal trends of these parameters. The results of the present study, as shown in (Table 2) about the statistical relationships between the different measured parameters coincides well with several previous works on goldfish and other cyprinid species under culture and natural conditions (Salah et al 2012).

Present study results concluded that the first maturity observed in between 9 months to 1 year old fish with peak spawning period February. The egg diameter, gonad weight, GSI %, absolute fecundity gradually increases near the peak spawning season. This study provides the base for new researches, aquarium fish developers in this particular region.

REFERENCE

- Alam, M., & Pathak, J. K. (2010). Assessment of fecundity and gonadosomatic index of commercially important fish *L. rohita* from Ramganga river. *Int J Pharma Biosci* 1(3):1-6. | Al-Noor, S. S. (2010). Population status of gold fish *Carassius auratus* in restored east Hammar Marsh southern Iraq *JKAU Mar Sci* 21(1): 65-83. | APHA, (1981). Standard methods for the examination of water and waste water. American Health Association, Washington D.C. 15 Ed. | Blaxter, J.H.S.(1988). Pattern and Variety in Development. In: W.S. Hoar and D.J. Randall (Eds.) *Fish Physiology*. Vol. XI. The Physiology of Developing Fish. Part A. Eggs and Larvae, Academic Press Inc. London, U.K. 1-58 pp. | Gupta, S., & Banerjee, S. (2009). Food preference of goldfish (*Carassius auratus* (Linnaeus, 1758)) and its potential in mosquito control. *Electronic J Ichthyol* 2: 47 - 58. | Lagler, K. F. (1966). *Freshwater Fishery Biology*. W.M.C. Brown Company Iowa 421 pp. | Lo, N.C.H., Smith, P.E., & Takahashi, M. (2009). Egg, Larval and Juvenile Surveys. In: Tore Jakobsen, Michael J. Fogarty, Bernard A. Megrey and Erlend Moksness (Eds.) *Fish Reproductive Biology: Implications for assessment and management*, Blackwell Publishing Ltd. Oxford U.K. 207-229 pp. | Martty, H., & Couto, D. D. (1973). *Peces tropicales Albatros*, Buenos Aires Argentina 129 pp. | Nikolsky, G.V. (1963). *The ecology of fishes*. Academic Press London England 352 pp. | Salah, M., Najim Raja, A. A., Mudhaffar, Al., & Furat, K. J. (2012). Some reproductive characters of the fantail goldfish *Carassius auratus auratus* females from rearing ponds in Basrah. *Southern Iraq Iraqi J Aquacult* 9 (1): 83- 94 |