ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Study of Gonadosomatic Index and fecundity of pond raised *Labeo dyocheilus* in cold water conditions

***Monika Gupta[1], N.N.Pandey[2], V. K. Tiwari[1], Raghvendra Singh[1], Chandra Prakash[1] and C.S. Chaturvedi[1]**

1. Central Institute of Fisheries Education, Versova-400 061 Mumbai, Maharastra, India.

2. Directorate of Coldwater Fisheries Research (ICAR), Bhimtal-263136, Nainital, Uttarakhand, India.

Manuscript Info

Manuscript History:

Received: 12 August 2013
Final Accepted: 23 August 2013
Published Online: September 2013

Key words:
Captivity, Coldwater conditions, Fecundity, Gonadosomatic Index, *Labeo dyocheilus*, Sexual maturity.

Abstract

In the present study, Gonadosomatic Index (GSI) and fecundity of *Labeo dyocheilus* reared under captivity in coldwater conditions have been reported. The GSI values of *L. dyocheilus* were ranging from 1.264 to 15.365. Average GSI value was at its peak in July (13.672±2.026) and lowest level was recorded in the month of December (1.542±0.400). Absolute fecundity was ranging from 42233 to 172887 ova with an average of 99216±42292 ova per fish. The ovarian weight is almost 15% of the body weight in fully mature fishes. In this study, it has been shown that *L. dyocheilus* is able to attain sexual maturity in coldwater conditions even if reared under captivity. Fecundity increases with the increase in weight of fish and that of ovary.

Introduction

Proper brood care is one of the very essential steps for the normal development of gonads to produce healthy fish seeds in any aquaculture practice. The gonad weight gives an easily measured quantitative record of changes in the condition of gonads. This is reported in terms of Gonadosomatic index (GSI) which plays a significant role to evaluate estimated spawning season of a species. Saksena (1987) has suggested the use of GSI and volume of the gonad as indicators of gonadal state. Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery (Lagler 1956, Doha and Hye 1970). The fecundity and GSI have also been studied in *Mystus gulio* (Sarker et al., 2002), in *Anabas testudineus* (Marimuthu, 2009) in *Labeo rohita* (Alam and Pathak, 2010). Normal gonadal development of fishes raised under captivity right from their juvenile or sub-adult stage is really major challenge in developing the complete package of practice of any fish species. Micale et al., 1999 studied the reproductive biology of the amberjack, *Seriola dumerilii* and ovserved that Captive reared females failed to not only spawn, but also to complete vitellogenesis and oocyte maturation. *Labeo dyocheilus*, is one of the most economically important and fast growing hill stream cyprinid. Incorporation of this high valued species is not only an important step in species diversification of hill aquaculture but will also improve the socio-economic cadre of poor farmers in hill region. Therefore, it is very important to know about GSI and fecundity of this carp, *L. dyocheilus* to get more and more information about its reproduction potential and usefulness as a candidate species for hill aquaculture. Although Pandey et al., 2011 studied GSI of *L. dyocheilus* in mid altitudinal region of Uttarakhand but the experimental fishes were collected in fully matured 3+year's age condition. Similarly Singh et al., 2008 observed normal ovarian development of *L. dyocheilus* under captivity in Pantnagar Tarai region of Uttarakhand state (29° N latitude, 79.3° E longitude and an altitude of 243.3 m above mean sea level) using adult fishes.

Therefore, the present investigation was focused to observe the GSI and absolute fecundity of *L. dyocheilus* when reared in ponds (captivity) under cold water conditions from their sub-adult stage to adult one.

Material and Methods

Experiment was carried out in Directorate of Coldwater Fisheries Research (DCFR) Bhimtal located in subtropical Himalayan region of Uttarakhand state, India (Latitude $29^0$21´ N, Longitude $79^0$34´ E, altitude 1370 m MSL). To study

aforesaid indices sub-adult specimens of *L. dyochelius* weighing from 180-310 g and length ranging from 21.6 to 28.50 cm were collected from the Kosi river Ramnagar Uttarakhand (29° 29.038' N latitude, 79.08777' E longitude and altitude 410 m MSL) during August, 2011 and stocked in cemented ponds at DCFR, Bhimtal. The fishes were kept under pond conditions till the end of study i.e August 2012. A few nos. of medium sized boulders were kept at the bottom of the cemented pond for facilitating good growth of periphyton and also to create a semi-natural environment to the fishes. Fishes were fed daily with supplementary feed @ 2-3% of their body weight (protein level 28 %). Length and weight of fishes were taken fortnightly. GSI was recorded for complete one year on monthly basis and fecundity was estimated during May-August 2012 when fishes reached a length of about 29.3-38.7 cm and weight 260-580 g. Three female fishes were sacrificed each month and average values of GSI and absolute fecundity were recorded. Total length of each fish was measured with help of a meter scale to the nearest 0.1cm. The body weight of each fish was measured by means of a single pan balance. After weighing the ovaries, one gram each from six cross sectional samples were taken from anterior, middle and posterior regions of the paired ovary. GSI and absolute fecundity were estimated using following formulae.

$$GSI = \frac{\text{Weight of gonad(g)}}{\text{Total body weight (g)}} \times 100$$

Absolute Fecundity = Number of ova in 1.0g of ovary × Total weight of ovary in g

Result and Discussion

The GSI values of *L. dyocheilus* were ranging from 1.264 to 15.365. Average GSI value increased gradually from month of January (1.432±0.036), attained a peak in July (13.672±2.026) and then started to decrease August (11.283±0.861) onwards and reached its lowest level in December (1.542±0.400). The high value of GSI is an indicative of mature stage of gonads in the fish (Mishra and Saksena, 2012). Similar trend in GSI was recorded by Singh et al., 2008 in *L. dyocheilus* kept under captivity who observed normal ovarian development of fish. Although the major difference was that they used adult fishes collected from wild and kept under captivity while in our study we collected sub-adult specimens and kept for 12 months under captivity to ensure full ovarian maturity in captive conditions. Another important point to note that Singh et al., 2008 accomplish their study in Tarai region of Uttarakhand where the agro-climatic conditions are entirely different from our experimental place, due to great difference in altitude. Average water temperature was 17±1.7ºC in our place of experiment while it was recorded 25.1- 27.9 by Singh et al., 2008 which clearly indicate that the fish is able to achieve its maturity normally even in coldwater conditions under captivity. Our findings also matched with the GSI pattern reported by Pandey et al., 2011 in *L. dyocheilus*. However, the agro-climatic conditions were same but the very much difference was with the age of experimental fish used by Pandey et al., 2011 who collected fully matured 3+year's age brood fishes from wild and stocked under coldwater pond conditions only from February, 2011 to August 2011 while our investigation clearly shows full maturity of the fishes collected during sub-adult stages and reared under captivity round the year in coldwater conditions.

Table 1. Monthly variation in GSI value of female *L. dyocheilus*.

Month	**Average weight of fish(g)** (Mean± SD)	**Ovary wt. (g)** (Mean± SD)	**GSI (%)** (Mean± SD)
Jan	343.33±61.10	4.931±0.98	1.432±0.036
Feb	350.00±88.88	6.868±2.36	1.934±0.173
March	370.00±98.48	9.905±5.24	2.568±0.656
April	353.33±123.42	12.041±6.77	3.245±0.699
May	346.66±60.27	17.025±2.60	4.923±0.185
June	451.67±75.88	43.42±18.99	9.361±2.667
July	532.67±54.60	73.28±17.85	13.672±2.026
Aug	430.00±45.82	48.56±7.548	11.283±0.861
Sept	383.33±90.08	35.911±9.53	9.262±1.038
Oct	420.00±122.88	14.850±6.71	3.425±0.693
Nov	360.00±75.49	9.592±3.11	2.624±0.484
Dec	391.67±29.29	6.120±2.08	1.542±0.400

Values presented are the average value of n=3

Table-2. Variation in Absolute Fecundity of *L. dyocheilus.*

Month	**Average weight(g)** **(** Mean± SD**)**	**Ovary weight(g)** **(** Mean± SD**)**	**Absolute Fecundity** **(** Mean± SD**)**
May	346.66±60.27	17.025±2.60	58054.83±16975
June	451.67±75.88	43.42±18.99	111167.87±48632
July	530.67±54.60	73.28±17.85	142180.53±34636
August	430.00±45.82	48.56±7.548	85461.26±13284

Values presented are the average value of n=3

The absolute fecundity was ranging from 42233 to 172887 ova with an average of 99216±42292 ova per fish. This finding is very much similar to Sarkar et al., 2001 who reported the absolute fecundity of 85838 of *L. dyocheilus* in riverine condition. The total fecundity of *L. calbasu* was reported by Mishra and Saksena, 2012 ranging from 312100 to 657600 ova with an average of 402217.0±30661 ova per fish. It is quite clear that female fish with greater weight had higher fecundity. Khan et al., 1992 announced that the higher values of fecundity were noticed in the fishes of higher weight range.

L. dyocheilus is fast growing high valued cyprinid of Himalayan uplands. Fecundity of this fish is very high as compared to other cold water fishes, which reflects the importance of this fish to be incorporated into coldwater aquaculture sector as a new candidate species.

Acknowledgement

The authors are thankful to the Director, Directorate of Coldwater Fisheries Research (DCFR), Bhimtal, and Director, Central Institute of Fisheries Education, Mumbai for providing the opportunity to carry out this work along with their valuable guidance, useful suggestions and facilities during the research. Authors are immensely thankful to PCCF (WL), Department of forest, Govt. of Uttarakhand for permitting to catch the test fishes. Authors are also thankful to ICAR, Govt. of India for providing research fellowship.

References

Alam, M. and Pathak, J. K. 2010. Assessment of fecundity and gonadosomatic index of commercially important fish, Labeo rohita from Ramganga river. *Internat. J. Pharma Bio. Sci.* **1(3)**: 1-6.

Doha, S. and Hye, M. A. 1970. Fecundity of the Padma River *Hilsa ilisha* (Hamilton). *Paki. J. Sci*. **22**: 176-183.

Khan, M. N., Janjua, M. Y. and Naeem, M. 1992. Breeding of carps with Ovaprim (LH-RH) Analogue at Fish Hatchery Islamabad. *Proc. Pakistan Congr. Zool.* 1**2**: 545.552.

Lagler, K.F. 1956. Ennumeration of fish eggs. In freshwater fishery biology. 2nd Edn. W.M. Brown company publishers. Dubuque: oo. 106-110.

Marimuthu, K., Arumugam, J., Sandragasan, D. and Jegathambigai, R. 2009. Studies on the fecundity of native fish climbing Perch (Anabas testudineus Bloch) in Malaysia, Am. Eurasian. *J. Sustain. Agric.* **3(3)**: 266-274.

Micale, V., G. Maricchiolo and Genovese L., 1999. The reproductive biology of the amberjack, Seriola dumerilii (Risso 1810): Oocyte development in captivity. *Aquaculture Res.*, **30**: 349-355 ().

Mishra, S. and Saksena, D. N. 2012. Gonadosomatic Index And Fecundity Of An Indian Major Carp *Labeo Calbasu* In Gohad Reservoir**.** *The bioscan.* **7(1)**: 43-46.

Pandey, N.N., Haldar, R.S., Ali, S., Kumar, P., Patiyal, R.S. and Mahanta, P.C. 2011. Induced spawning of *Labeo dyocheilus* in captivity under cold water condition. *J. Inland fish Soc. India*, **43(2)**,44-48 .

Saksena, D. N. 1987. On the use of gonado-somatic index and volume of the gonads as indicators of gonadal state in India fresh water goby, Glossogobius giuris (Ham.) with a note on the role of temperature in fish reproduction. *Intl. J. Ichthyol.* **8(1)**: 1-8.

Sarkar, U.K., Patiyal.R.S.and Srivastava, S.M. 2001. Successful induced spawning and hatching of hill stream carp, *L. dyocheilus* in Kosiriver. *Indian. Jr. Fish*, **48**(4) :413-416

Singh, A., singh, I.J.,Ram, R.N. and Kushwaha, B. 2008.Ovarian development in *Labeo dyocheilus* (McClelland) during active reproductive phase under captive and wild conditions. *J. Evn. Bio.*, **29**(2)169-74.