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Assessment of Spawning Fecundity and its Relation with Body Parameters in Brown Trout (*Salmo trutta fario*) of Kashmir Himalayas

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ABSTRACT

Background and Objective: Fecundity is an essential index of fish biology and is often used to evaluate the reproductive potential of particular fish species that must be understood to explain the variations in the level of the fish population, as well as to make efforts to increase the aquaculture harvest and production. The purpose of the study was to understand the relationship between total body length, body weight, spawning fecundity and relative fecundity in brown trout (*S. trutta fario*). **Materials and Methods:** Male and female brown trout were segregated before stripping. Eggs were stripped in dry, clean plastic bowls by applying gentle pressure to the abdomen of female rainbow trout. Spawning fecundity was determined by counting the total number of stripped eggs per female brown trout. The total length (cm) of male and female rainbow trout was determined and the total body weight (g) was calculated. Data were analyzed using MS Excell, PAST Software. Correlation between the body size and spawning fecundity was estimated. **Results:** The mean length of male brown trout (38.86±1.41 cm) while the mean length for female brown trout (37.98±1.30 cm) was observed. The average weight of male and female brown trout was 772.7±41.4 and 757.6±57.22 g, respectively. The spawning fecundity per female fish ranged from 961-1604 eggs, with a relative fecundity of 1.41-1.56/g body weight. **Conclusion:** The current study noticed a significant positive association between total body length and body weight of male and female brown trout. Similarly, a significant positive correlation was recorded between total body length and spawning fecundity, body weight and spawning fecundity of brown trout were observed. However, relative fecundity formed a significant negative correlation between total length, body weight and spawning fecundity.

KEYWORDS

Salmo trutta fario, spawning fecundity, eggs, relative fecundity, total body length, body weight, correlation

INTRODUCTION

Salmo trutta fario is a cold water species belonging to the family Salmonidae and was first introduced to Kashmir around 1900[1]. Brown trout are currently thriving in the cold water streams of Kashmir Valley and are the most well-known freshwater species found in Sindh, Bringi, Lidder, Ferozpur, Erin and other areas[2].

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In the management of sport and commercial species, the size at which fish reach sexual maturity and the number of eggs they produce are important considerations. Studies on the fecundity of a fish reveal helpful information about the breeding potential of a fish species. Fish stock fecundity is an important aspect of fishery biology because it influences fish productivity, stock recruitment and stock management. Estimating fecundity is crucial not just for these requirements, but also for understanding various species because different species have varying fecundity and egg diameter, it's easier to study if a population is homogenous (one species) or heterogeneous (many species)[3]. Alam and Pathak[4] reported that the fecundity estimates of *L. rohita*, were more closely associated with the ovary weight. Manually stripping the eggs from the fish at full maturity, the number of ripe eggs released by brood fish can be determined without difficulty, this number is known as fecundity. Fecundity is often referred to as total or absolute fecundity, or simply fecundity, when expressed in terms of the number of eggs produced per brood fish. Alternatively, relative fecundity is defined as fecundity expressed per unit body weight of post-stripped fish.

The fecundity component of reproduction is intimately associated with population dynamics research and fisheries management practices. This aspect of fishery biology has been contributed by several researchers[5,6].

The present study aimed to determine the relationship between length-weight, spawning fecundity and relative fecundity in *S. trutta fario* of Kashmir Himalayas.

MATERIALS AND METHODS

The current study was conducted in November, 2020 at Trout Culture Farm, Laribal, Srinagar (J&K Govt.), which is located about 20 km from District Srinagar. Healthy stocks of male and female brown trout were collected for experimentation. The relationship between total body length, body weight, spawning fecundity and relative fecundity was estimated. The data was collected after the fishes were anaesthetized.

Spawning fecundity: Females' abdomens were gently pressed to obtain eggs, which were then placed in dry, clean plastic bowls. The total number of stripped eggs per female brown trout (*Salmo trutta fario*) was used to calculate spawning fecundity.

Relative fecundity: It was calculated as the total number of stripped eggs divided by the weight of the fish.

Estimation of total length and total weight: The total length of male and female brown trout was determined using a Vernier calliper (Trusize absolute digimatic, Srinagar, Jammu and Kashmir, India). The total weight was determined using an electronic weighing balance (Thomson weighing scale, D-112).

RESULTS

The length of female brown trout ranged from 32.3-45.4 cm with a mean value of 37.98±1.30 cm while for male brown trout, the length ranged from 30.3-45.7 cm with a mean value of 38.86±1.41 cm. The observed weight of female brown trout ranged from 615-1137 g with a mean value of 757.6±57.22 g while the male brown trout weighed in the range of 613-975 g with a mean value of 772.7±41.4 g (Table 1).

The data revealed that there was a significant positive correlation observed between the length and weight of male brown trout ($r = 0.947$, $p<0.01$) and the length and weight of female brown trout ($r = 0.924$, $p<0.01$) (Table 2).

The spawning fecundity of female brown trout ranged from 961-1604 eggs and the mean spawning fecundity of 1124.8±71.60 eggs was observed (Table 3). The relative fecundity ranged from a minimum of 1.41 to a maximum of 1.56 per gram of fish weight with a mean value of 1.49 per gram of fish.

Table 1: Descriptive statistical length and weight of male and female *S. trutta fario*

	Female		Male	
	Length (cm)	Weight (g)	Length (cm)	Weight (g)
Minimum	32.30	615.00	30.30	613.00
Maximim	45.40	1137.00	45.70	975.00
Mean	37.98	757.60	38.86	772.70
Standard error	1.30	57.22	1.410	41.44

Table 2: Pearson's correlation between total length and body weight of male and female brown trout (*S. trutta fario*)

	Length-female	Weight-male
Length-male		0.947*
Weight-female	0.924*	

*Correlation is significant at a 0.01 level

Table 3: Descriptive statistics of total body length, body weight, spawning fecundity and relative fecundity of *S. trutta fario*

	Total length (cm)	Total weight (g)	Spawning fecundity (eggs/fish)	Relative fecundity (/g body weight of fish)
Minimum	32.30	615.00	961.00	1.41
Maximum	45.40	1137.00	1604.00	1.56
Mean	37.98	757.60	1124.80	1.49
Standard error	1.30	57.22	71.60	0.017

Table 4: Relationship between total body length, body weight and spawning fecundity and relative fecundity of brown trout

	Total length	Body weight	Relative fecundity
Total length (cm)		0.924**	-0.902*
Spawning fecundity	0.913**	0.997**	-0.849*

**Correlation is significant at a 0.01 level

The Pearson's correlation between total length, body weight and spawning fecundity of brown trout indicated that there was a significant positive correlation between total length and spawning fecundity ($r = 0.913$, $p<0.01$), between total length and body weight ($r = 0.924$, $p<0.01$), between body weight and spawning fecundity ($r = 0.997$, $p<0.01$). However, a significant negative correlation was formed between the total length of fish and relative fecundity ($r = -0.902$, $p<0.05$) and between spawning fecundity and relative fecundity ($r= -0.849$, $p<0.05$) (Table 4).

DISCUSSION

The study of fecundity to body size is essential as the fish weight varies with the approach of the spawning season. Fecundity is frequently linked to the fish's length, weight and age of fish as well as to the volume of the ovary. Several workers reported a straight-line relationship between the fish weight and fecundity[7-9]. Bhuiyan *et al.*[10] found a positive association between fecundity and body size. In the current study, spawning fecundity ranged from 961-1604 eggs/fish, with a mean value of 1124.8 eggs/fish, whereas relative fecundity ranged from 1.41-1.56 eggs/gram of fish weight, with an average value of 1.49 per gram of fish weight. The findings of the former studies comply with the outcomes of this study. Mohamad *et al.*[8] observed relative fecundity in *Cyprinus carpio* var. *Communis* had a significant negative correlation with body weight, total length and absolute fecundity ($r = -0.747$, $p<0.01$, $r = -0.419$, $p<0.05$ and $r = -0.460$, $p<0.05$ respectively). Fecundity generally increased with the total length in several fishes. The results reported by the above-mentioned researcher[8-9] are in agreement with the present study as relative fecundity formed a significant negative correlation between body weight, total length and spawning fecundity in brown trout. The knowledge of the fecundity of fishes is an important aspect of fisheries, population dynamics and food availability items. The study of fecundity to body size is essential as the fish weight varies with the approach of the spawning season. The present study recommends the application The study of reproductive estimates of fishes is an important component in fishery biology, so far, it has its applications in solving some fishery management questions such as the determination of

spawning stock. The accessible data based on reproductive parameters of fish lead to a better understanding of observed variation in reproductive potential and enhances our ability to estimate recruitment.

CONCLUSION

Overall, the findings of this study showed that the spawning fecundity of brown trout increases as the fish size increases in total length and body weight. However, total body length, body weight and spawning fecundity all had a significant negative association with relative fecundity indicating that increase in the fish size and spawning fecundity, relative fecundity decreases.

SIGNIFICANCE STATEMENT

The study discovers a relationship between the spawning potential of brown trout (*S. trutta fario*) that can be beneficial to aquaculture and fish farmers to increase the production levels of brown trout. The current research is beneficial concerning the cultural activities of brown trout in terms of development and growth.

REFERENCES

1. Bazaz, A.I., T.H. Shah, I. Ahmad, F.A. Bhat and A. Abubakr *et al*., 2021. Influence of thermal shock intensity on the early developmental stages of eggs in cold water salmonid species, brown trout (*Salmo trutta fario*), in the hatcheries of Kashmir Himalayas. Biol. Forum Int. J., 13: 573-579.
2. Shah, T.H., M.H. Balkhi and O.A. Asimi, 2009. Experiments on the rearing of rainbow trout *Oncorhynchus mykiss* Walbaum in Kashmir. Nat. Environ. Pollut. Technol., 8: 225-230.
3. Shafi, S., 2012. Study on fecundity and GSI of *Carassius carassius* (Linneaus, 1758-introduced) from Dal Lake Kashmir. J. Biol. Agric. Healthcare, 2: 68-75.
4. Alam, M. and J.K. Pathak., 2010. Assessment of fecundity and gonadosonatic index of commercially important fish, *Labeo rohita* from Ramganga River. Int. J. Pharma Bio Sci., Vol. 1.
5. Mekkawy, I.A.A. and A.A. Hassan, 2011. Some reproductive parameters of *Synodontis Schall* (Bloch and Schneider, 1801) from the River Nile, Egypt. J. Fish. Aquat. Sci., 6: 456-471.
6. Shinkafi, B.A., J.K. Ipinjolu and W.A. Hassan, 2011. Gonad maturation stages of *Auchenoglanis occidentalis* (Valenciennes 1840) in River Rima, North-Western Nigeria. J. Fish. Aquat. Sci., 6: 236-246.
7. Somdutt, S. and S. Kumar, 2004. Studies on fecundity of *Puntius sarana* (Ham.) in relation to total length, total weight and ovary weight. J. Indian Fish. Assoc., 31: 81-85.
8. Mohamad, I., F.A. Bhat, M.H. Balkhi, T.H. Shah, B.A. Bhat and A. Wali, 2018. Relationship among body weight, body length, ovary weight and the fecundity of *Cyprinus carpio* Var. *communis* in Kashmir Himalaya. J. Pharmacogn. Phytochem., 7: 2018-2020.
9. Alp, A., C. Kara and H.M. Büyükçapar, 2003. Reproductive biology of brown trout, *Salmo trutta macrostigma* Dumeril, 1858 in a triburaty of the Ceyhan River which flows into the Eastern Mediterranean Sea. J. Appl. Ichthyol., 19: 346-351.
10. Bhuiyan, A.S., K. Islam and T. Zaman, 2006. Fecundity and ovarian characteristics of *Puntius gonionotus* (Bloch/Bleeker) (Cyprinidae: Cypriniformes). J. Bio-Sci., 14: 99-102.