International Research Journal of Natural and Applied Sciences
Vol. 4, Issue 4, April 2017 Impact Factor- 5.46
ISSN: (2349-4077)
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Website: www.aarf.asia Email : editor@aarf.asia , editoraarf@gmail.com

REPRODUCTIVE BIOLOGY OF HILL STREAM FISH *GARRA LAMTA* (HAMILTON-BUCHANAN) OF PETSAL AND SIRONIA GARH (TRIBUTARIES) OF SUYAL RIVER OF KUMAUN HIMALAYA

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ABSTRACT

The present study deals with the fecundity, sexual dimorphisms, spawning season, age distribution and sex ratio (reproductive biology) of hill stream fish Garra lamta collected from Petsal and Sironia garh (tributaries) of Suyal river in Kumaun Himalaya, Uttarakhand. The fish breeds once in a year and the breeding season extended from April to June. Fecundity of the fish varied from 2640 to 9837 in the fish measuring from 82 mm to 126 mm (3^{++} to 4^{++} years age) with straight line relationship to the fish body. During breeding period male and female Garra lamta usually developed secondary sexual characters. The GSI varied between 0.4 to 14.2 in male and 1.1 to 19.0 in female. The age composition showed that fishes of 4^{+} years are rare than $1^{+}<2^{+}<3^{+}$ years of age in the population. The ratio of female to male was found to be 0.91:1.0 with seasonal and monthly variation in the stock.

Key words: Hill stream fish, Reproductive biology, Spawning, Fecundity, *Garra lamta*, Sex ratio.

Introduction

A study on reproductive biology of fishes is an important aspect for the fish conservation. In fish, reproduction is usually a seasonal activity hence it may be precisely timed so that the young appears when food is abundant and other conditions are optimal for survival (Sahai, 1998). The success of any fish species is ultimately determined by the ability of its members to reproduce successfully in a fluctuating environment (Moyle and Czech, 2000). Some recent studies have

been made on reproductive and spawning biology of fishes which are closely associated with environmental changes viz., temperature, day length and food supply have been recorded by Ojha (2002) and Sahai (1998) Singh *et al.* (2008), Powter and Gladstone (2008), Rideout and Morgan (2007), Hardie *et al.* (2007), Knight *et al.* (2007), McBride and Johnson (2007), Gomes-Jr and Monteiro (2007), Chakraborty *et al.* (2007), Musa and Bhuiyan (2007), Kumar *et al.* (2006), Murua and Motos (2006), Mandal *et al.* (2005) and Singh and Lakra (2000). An attempt has been made on the spawning season of *Garra lamta* in the lotic water of Petsal and Sironia garh, (tributaries) of Suyal river of Kumaun Himalaya for the first time. Some recent contributions on population, fecundity and sexual dimorphism studies of some Uttarakhand fishes are by Joshi and Pathani (2009), Singh and Lakra (2000), Pathani (1981) and Pathani and Das (1978). The present study on population (stock-size) sex-ratio and age distribution of *Garra lamta* was recorded for the first time in Petsal and Sironia garh (tributaries) of Suyal river of Kumaun region for two years (2006-08).

Materials and Methods

Fish specimens were collected from the field as a regular monthly task during the period October 2006 to September 2008 from the Petsal garh (elevation 1230msl), and Sironiya garh (elevation 1170msl), tributaries of Suyal river. The freshly living fish specimens were carried to the Zoological laboratory of Kumaun University, Soban Singh Jeena Campus, Almora for recoding the different data.

Gonado somatic index (GSI) estimated by applying the following formula:

$$GSI = \frac{\text{Weight of gonads x } 100}{\text{Weight of fish}}$$

The total fecundity of fish was recorded by the Gravimetric methods. The eggs were counted which are visible to the naked eyes in the ripe ovary of the fish and estimated by following method:

$$F = \frac{S \times O_w}{100}$$

Where, F= fecundity; S= Average number of eggs obtained from 3 different samples of 100 mg each; O_w = Total weight of ovary.

Various relationships between fecundity and fish length, fish weight and relationship between ovary weight and fish weight were obtained by plotting graph between two variables separately and the relationships were established with the help of least square methods and follows:

Fish length and fecundity: **F = a + b L**

Fish weight and fecundity: **F = a + b W**

Ovary weight and fecundity: **F=a + b Wo**

Where, F = Fecundity; L= Total length of fish; W= Weight of fish; Wo= Weight of ovary

Weight of fish and weight of ovary **Wo = a +bW**

'a' and 'b' constants estimated by statistical methods.

$$\textbf{Comparative fecundity (No. of ova/ gm body weight)} = \frac{\textbf{Total number of Ova}}{\textbf{Fish weight (gm)}}$$

The spawning season of fish was attempted by the regular visualization of gonads, some morphological structure on the body and collection of fertilized eggs/fingerling/ fry of the fish. The dip net was used to collect the fertilized egg, fish fry and fingerlings at the shallow running water along the banks of the river. The population distribution of *Garra lamta* was evaluated by the catch data during October, 2006 to September, 2008.

Result

General morphology of testes: The testes of *Garra lamta* are paired, elongated structures, situated ventrally on either side of the kidney in the posterior region of the visceral cavity. The testes remain attached to the body wall and the air bladder by means of mesorchia and the testes of the two sides remain free in the visceral cavity except at the posterior part where they fused to form a common spermatic duct. The testes are broader at the anterior end, creamy white in colour and occupy a position ventral to the air bladder. Posteriorly they fuse to form a single spermatic duct which opens into the urinogenital opening into the anal pore. The size, shape, vascularity, weight and colour of the testes of *Garra lamta* vary according to the seasonal gonadal cycle and are correlated to the degree of maturation of testes. During non breeding season testes are observed to be thin, slender, translucent and white in colour, while during breeding season the testes enlarged gradually in their weight and volume and become slightly reddish in colour due to presence of milt and blood capillaries.

General morphology of ovary: The ovaries of *Garra lamta* are paired, elongated, sac like structures which are extending along the whole length of the body cavity on both side of the

vertebral column at the lower end of the visceral cavity and ventral side of the bladder. These are attached to the body wall by means of 'mesovarium'. The anterior ends of the two ovaries are free but their caudal ends become united into one. The ovaries of the either side are almost equal in size and texture and undergo remarkable seasonal variation. In early growth phase they are flaccid, delicate and translucent structure of light pink colour, becoming much distended and enlarged with mulberry like appearance due to presence of large ova heavily loaded with yolk during the breeding period of the fish. The colour of the ovary turns light pink to yellowish pink from immature to mature stage. They attain their maximum weight during May-June due to presence of mature/ripe ova and thereafter it declines owing to the release of ripe ova in the spawning sites.

Fecundity: The total number of ova ranged from 2640 to 9837 in size range from 82 to 126mm. The fish was mainly 3-3^{++} to 4^{++} years age in the collection shows the female fish, *Garra lamta* matures only after 3 years of age. The relationship between fecundity and fish body measurements has been made as follows:

Relationship between total length of fish and fecundity: The total length of fish, *Garra lamta* ranged from 82 to 126mm in the study. The fecundity of fish increases with the length of the fish in the study. The coefficient of correlation found to be very strong (r = 0.805419) between total length and fecundity (Table 2 and Figure 1) of fish *Garra lamta* can be expressed as:

Fecundity = Length of fish X 175.24 -11252

Where, Slope b =175.24; Intercept = -11252

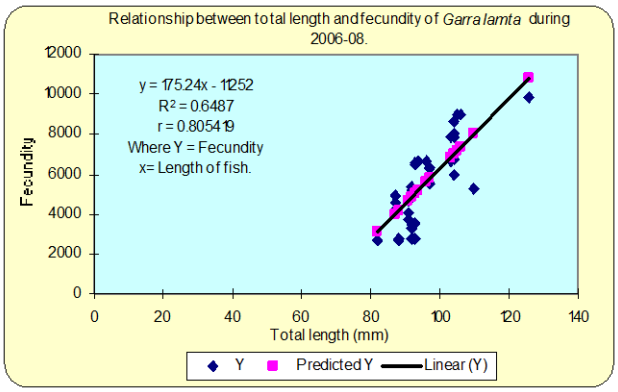

Figure 1 – Relationship between fish length and fecundity of *Garra lamta.*

Relationship between total weight of fish and fecundity: The body weight of fish, *Garra lamta* ranged from 6.0 to 22.5gm to be minimum and maximum in the study. The derived

equation of relationship between the fish weight and fecundity (Table 2 and Figure 2) of *Garra lamta* fish can be written as

Fecundity = Weight of fish X 414.32 + 900.9

Where, Slope b = 414.32; Intercept = 900.9

The coefficient correlation r = 0.6653229.

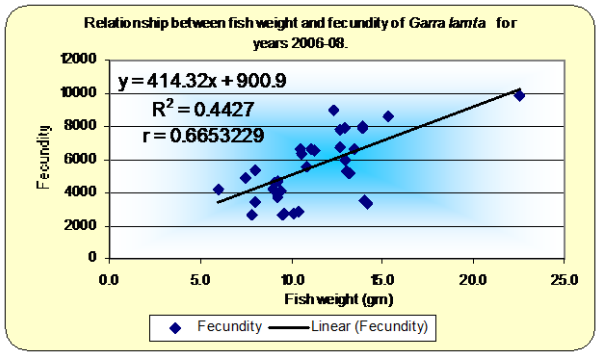

Figure 2 – Relationship between weight and fecundity of *Garra lamta*.

Relationship between weight of ovary and fecundity: The weight of ripe ovary of fish, *Garra lamta* ranged from 1.2gm to 4.9gm to be minimum and maximum and the fecundity observed between 2640 to 9837. The straight line relationship between ovary weight and fecundity was more close in comparison to all other relationship (Figure 3 and Table 2). The equation of relationship obtained as:

Fecundity = 1835.7 X weight of ovary + 1245.3

Where, Slope = 1835.7; Intercept = 1245.3

The coefficient of correlation r = 0.94566.

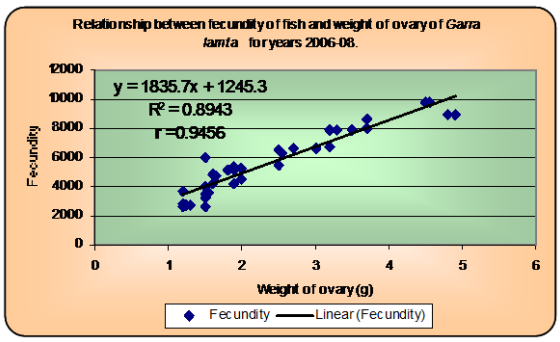

Figure 3 – Relationship between weight of ovary and fecundity of fish.

Relationship between weight of fish and weight of ovary: The body weight of fish, *Garra lamta* ranged from 6.0 to 22.5gm to be minimum and maximum and the weight of ripe ovary

ranged from 1.2 to 4.9gm in the study. The derived equation of relationship between the fish weight and weight of ripe ovary of the fish can be expressed as

Weight of ovary = Weight of fish X 0.2059 + 0.043

Where, Slope b = 0.2059; Intercept = 0.043.

The coefficient correlation r = 0.6418 (Table 2 and Figure 4).

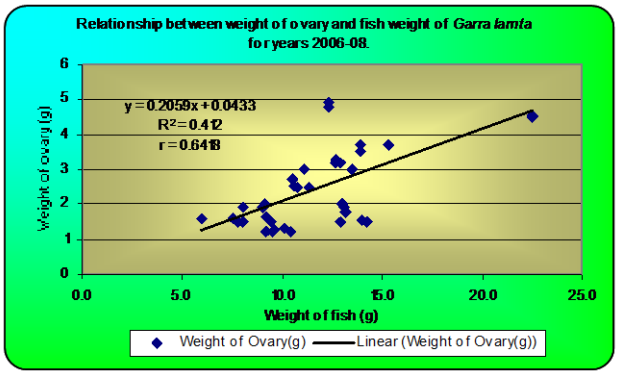

Figure 4 – Relationship between fish weight and weight of ovary of *Garra lamta* during 2006-08

Comparative fecundity: The comparative fecundity is a measure of the productivity potential of the fish and is expressed as the ratio between the number of ova and the body weight of the fish. The number of ova per gram body weight fluctuated in different length with the maturation stage of the fish. It appears that the larger fish has low comparative fecundity in comparison to the small fish. Comparative fecundity range from 129.03 ova to 466.66 ova per gram of fish weight of *Garra lamta* in the study (Table 2).

Sexual dimorphism: The male and female specimen of *Garra lamta* can be easily discriminated by means of secondary sexual characters during the spawning periods (April to June; Figure 5). The ventral fins of male fish become broader in comparison to female fish. The female fish have developed larger barbels, head upper ridge more prominent, straight and snout shows more insertions than male fish. The area between eyes is darker in male than female and the area is light pinkish to yellow in colour in female. Besides, during breeding period male snout becomes smooth while female usually developed fringe with breeding tubercles on the snout (Figure 5) which causes the length of snout longer to the same size of male fish. Sexual dimorphism confirms the breeding period by applying pressure on abdomen, causes to release the ripe ova/milt from urinogenital pore/anus of *Garra lamta* during said period.

Figure 5 – Sexual dimorphism in male and female *Garra lamta*

Gonado somatic index (GSI): The gonado somatic index or GSI of *Garra lamta* ranged between 0.4 to 14.2 in male and 1.1 to 19.0 in female during two years (2006-08). The minimum value recorded in the month of August (0.7) and January (0.4) and the maximum was in the month of April (14.2 and 10.9) in the male fish and it was minimum in the month of December (1.3 and 1.1) the maximum in the month of May (19.0) and June (16.9) in female *Garra lamta* during the first and second year. A peak of GSI of both the sexes during summer to monsoon season indicates the single spawning season of the fish (Figure 6). The GSI indicates that the male ready to spawn early in second week of April and becomes spent abruptly in comparison to female where it extends from April to May. The spawning season extends from April to June in female. After spawning resting phase of fish starts and it extends from August to February and it may be called as post (August to October) and pre (January to March) spawning periods.

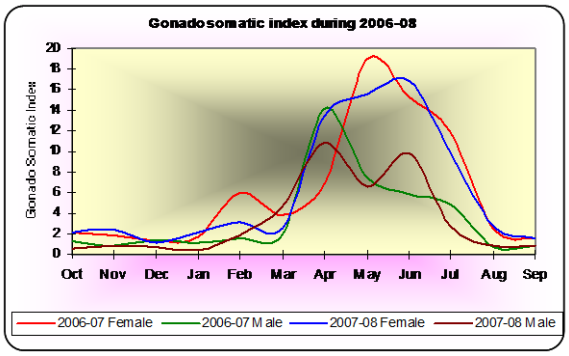

Figure 6 – Gonadosomatic index of *Garra lamta*.

Spawning season: The determination of spawning season was possible by regular monthly examination of *Garra lamta* for two years. The spawning period of the fresh water hill stream fish, *Garra lamta* extended from the late April to June in each year. The spawning period of *Garra lamta* has also been confirmed with the help of collection of fertilized eggs and fries, fingerling and adult from spawning sites during spawning season in the month of May, June and

July and by gonado somatic index (GSI) and secondary sexual characters of *Garra lamta* in the study. The observations confirm that the *Garra lamta* of Petsal and Sironia garh of Suyal river of Kumaun Himalaya spawns once in a year in the months of May and June. During this period a large number of ripe eggs in female and milt in male, respectively emit out on applying a slight pressure on the vent of the fish.

Age-distribution: The fishes were caught on monthly basis which showed low catch during cold months (December, January and February) and high catches during post spawning season and rainy season (July –September; Table 3). The general picture of age composition showed that fishes of 4^+ years are rare then $1^+ < 2^+ < 3^+$ years of age in the water (Table 4). The population of the catches of different aged *Garra lamta* can be expressed in percentage composition as the lowest IV years age (10.69%) then I year age (16.27%) and II years age (23.25%) and the maximum was III years aged (49.76%) in first year (Table 4). Similarly in the second year the maximum fishes were caught during spawning and rainy season i.e. June, July and August and the lowest during colder months (Table 3). Similar to former year the IV years aged fishes are lowest (9.85%) in the latter year then I year aged fishes (18.77%), II years aged (23.94%) and the maximum population also recorded in III years aged fishes (47.41%). So it is clear that the 4^+, 1^+ and 2^+ years ages fishes were low in number than the adult and mature fish of 3^+ years of age in the stock. Therefore, 3 years *Garra lamta* are caught by the fishermen in the water of Petsal and Sironia garh of Suyal river. The age composition shows that generally mature fishes dominating in the stock population, which are caught even during spawning season in the water.

It was observed that the fish in the age group of 4^+ years are present in low percentage in the water of Petsal and Sironia garh of Suyal river (Table 4). The fishes of this group constitute less than 11% in 2006-07 and 10% in 2007-08 in the catch showed that the large and mature fishes caught before reach from 3^{++} to 4 year age in the water. Fishes in the age group 3^+ years dominate the population. The fish of this group constitutes more than 47.4 to 49.7% in the catch of the fish. The age groups 1^+ and 2^+ years are moderate and constitute moderate percentage of the population in the study. Therefore the variability of age group on year-wise is also evident in the study. (Table 4). During the present investigation month wise fluctuations in age groups and number of fishes were also observed.

Sex- ratio: The specimens of *Garra lamta* collected from Petsal and Sironia garh of Suyal river of Kumaun Himalaya were analyzed for the sex-ratio in the stock. The male specimens are dominating over the female (Table 5). The ratio of female to male was found to be 0.91: 1.0 with

seasonal and monthly variations in the stock. Generally, the male have been observed to be dominated the fish stock during the resting period of gonads of the fish and female fishes dominated during some months in spawning season. The highest number of males were observed in the month of July, August and September and the lowest number were observed in the month of January, February and April with higher number of female in the first year of the study in the water (0.8:1 and 0.9:1 during first and second years, respectively). Almost equal number of male and female *Garra lamta* in the stock shows less chance of fertilization and production in the water.

Table 1 –Gonado somatic index of *Garra lamta* during 2006-08.

Month	**2006-07**		**2007-08**	
	Female	**Male**	**Female**	**Male**
Oct	2.2	1.3	2.1	0.6
Nov	1.8	0.8	2.5	0.8
Dec	1.3	1.4	1.1	0.7
Jan	1.7	1.2	2.2	0.4
Feb	6.0	1.6	3.1	1.8
Mar	3.9	2.0	2.6	4.7
Apr	6.8	14.2	13.5	10.9
May	19.0	7.4	15.6	6.6
Jun	15.3	5.9	16.9	9.8
Jul	11.8	4.9	9.9	2.7
Aug	2.5	0.7	2.7	0.8
Sep	1.6	0.9	1.6	0.8

Table 2 –Total length, body weight, ovary length, ovary weight, fecundity and comparative fecundity of female *Garra lamta* for two year 2006-08.

S.N.	Total length (mm)	Weight (gm)	Ovary Length (mm)	Ovary Weight (gm)	Fecundity	Comparative fecundity
1	104	12.9	36	1.5	5986	144.23
2	88	9.5	28	1.2	2640	136.36
3	92	14.2	28	1.5	3300	163.04
4	97	10.8	39	2.5	5520	257.73
5	103	13.5	46	3.0	6660	291.26
6	104	13.9	46	3.5	7897	336.53
7	126	22.5	52	4.5	9837	357.14
8	82	7.8	36	1.5	2658	182.92
9	91	9.4	36	1.5	4050	164.83
10	104	15.3	47	3.7	8590	355.76
11	87	9.0	40	1.9	4180	218.39
12	91	9.2	36	1.2	3690	131.86
13	94	11.1	40	3.0	6610	319.14
14	106	12.3	40	4.8	8965	452.83
15	87	6.0	26	1.6	4225	183.90
16	92	8.0	30	1.9	5356	206.52
17	92	13.2	32	1.8	5123	195.65
18	93	11.3	40	2.5	6512	268.81
19	96	10.5	39	2.7	6665	281.25
20	104	12.7	43	3.2	6691	307.69
21	87	7.5	36	1.6	4890	183.90
22	92	10.1	46	1.3	2760	141.30
23	93	10.4	45	1.2	2790	129.03
24	88	9.6	27	1.3	2780	142.04
25	93	14.0	29	1.6	3550	166.66
26	97	10.6	40	2.6	6320	262.88
27	103	12.9	46	3.2	7860	310.67
28	104	13.9	46	3.7	7997	355.76
29	126	22.5	50	4.6	9815	361.11
30	87	9.1	39	2.0	4550	229.88
31	91	9.2	36	1.7	4690	181.31
32	94	11.1	40	3.0	6650	319.14
33	105	12.3	41	4.9	8956	466.66
34	92	13.1	32	1.9	5163	206.52
35	93	11.3	41	2.5	6530	268.81
36	96	10.5	41	2.7	6630	281.25
37	104	12.7	43	3.3	7850	317.30
38	110	13.0	38	2.0	5236	181.81
39	92	8.0	32	1.5	3435	163.04

Table 3 – Total length and weight distribution of *Garra lamta* in Petsal and Sironia garh (combined) of Suyal river during 2006-08.

Month	2006-07			2007-08		
	Total length (cm)	**Body weight (gm)**	**No. of specimens**	**Body length (cm)**	**Total weight (gm)**	**No. of specimens**
October	6.8-8.9	4.0-9.0	16	6.8-9.4	3.8-11.7	25
November	7.1-8.9	8.0-9.3	16	7.1-9.6	8.0-12.0	19
December	8.2-10.6	8.0-16.0	12	5.5-10.6	1.9-18.0	13
January	4.7-10.3	2.9-12.5	11	6.1-9.5	2.6-10.4	7
February	6.3-10.4	2.4-11.9	12	7.2-10.5	4.3-13.7	17
March	5.9-7.1	1.8-4.0	17	4.9-9.3	1.6-10.5	16
April	6.1-10.4	2.3-12.9	18	8.2-10.4	7.5-15.3	17
May	7.2-12.6	5.6-22.5	23	6.6-10.6	4.1-12.3	19
June	6.6-10.8	2.9-14.2	19	7.8-10.1	5.5-13.4	29
July	7.8-11.1	5.8-18.9	21	8.5-13.0	7.8-22.6	25
August	5.1-10.9	1.0-15.0	24	7.7-10.3	5.0-15.0	14
September	4.8-11.1	1.8-19.5	26	7.7-12.0	6.7-23.6	12
Total			215			213

Table 4 – Monthly age composition and yearly percentage of *Garra lamta* for year 2006-08.

Age of fish	Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
1st	I	2	3	0	1	0	0	0	2	4	9	8	6	35	16.27
	II	7	4	1	0	0	4	0	6	8	10	0	0	40	18.77
2nd	I	4	3	0	4	3	12	3	3	5	2	4	7	50	23.25
	II	5	6	3	3	5	6	4	2	5	4	6	2	51	23.94
3rd	I	9	10	12	6	9	5	10	12	8	5	9	12	107	49.76
	II	11	9	9	4	12	6	9	7	9	8	8	9	101	47.41
4th	I	1	0	0	0	0	0	5	6	2	5	3	1	23	10.69
	II	2	0	0	0	0	0	4	4	7	3	0	1	21	9.85

Table 5 – Sex ratio of *Garra lamta* for year 2006-08.

Months	2006-07			2007-08		
	Female	Male	F:M	Female	Male	F:M
Oct	8	8	1:1	13	12	1.0:1
Nov	8	8	1:1	9	10	0.9:1
Dec	3	9	0.3:1	5	8	0.6:1
Jan	6	5	1.2:1	4	3	1.3:1
Feb	7	5	1.4:1	10	7	1.4:1
Mar	7	10	0.7:1	7	9	0.7:1
Apr	11	7	1.5:1	10	7	1.4:1
May	12	11	1:1	11	8	1.3:1
Jun	9	10	0.9:1	15	14	1:1
Jul	8	13	0.6:1	8	17	0.4:1
Aug	11	13	0.8:1	6	8	0.7:1
Sep	11	15	0.7:1	6	6	1:1
Annual	101	114	**0.8:1**	104	109	**0.9:1**

Discussion

Fishes with high mortality in eggs and juveniles stages are known to have high fecundity (Das, 1964). Fecundity study of the present fish is not known which is important for the successful management of fishery as it is directly related to the population estimation and production of *Garra lamta* in Kumaun Himalaya. The fecundity of a number of species has been already studied by several workers but some recent ones are by Pathani, 1981, 1982; Gaur and Pathani, 1996; Kiran and Puttaiah, 2003; Kumar *et al.*, 2006; Shamsan, 2008; Joshi and Pathani, 2009. Ojha, 2002 has reported the fecundity ranged from 1636 to 4610 of *Garra lamta* in Bihar. Similarly Kumar *et al.*, 2006 obtained fecundity to be 2225 to 8840 in *Botia dayi* in Garhwal waters. Dobriyal and Singh (1989) noted the total fecundity as 1710 to 8050 in *Glyptothorex pectinopterus.* Kumar *et al.* (2006) have shown straight line relationship between body length, weight and ovary weight with fecundity as like in the present fish, *Garra lamta*. The fecundity was more dependent on ovary related parameters (ovary weight, r = 0.94566) than the body related parameters (length, r = 0.805419 and weight, r = 0.6653229) in the present study. Similar relationship have been also reported by several workers (*op cit.*).

The present fish, *Garra lamta* is a small sized fish having 129 to 467 eggs per gram body weight of the fish. It is quite high in comparison to the comparative fecundity of large size fish *Tor putitora* of Kumaun waters reported by Pathani (2000). Other hand, the comparative fecundity varied from 41-435 eggs per gram, body weight of *Cryprinus carpio* of Govind Sagar

reported by Johal *et al.* (2000). It appears that the fishes which are small in size and weight as in the *Garra lamta* have generally more comparative fecundity than the large sized fishes.

Garra lamta attains maturity when it is of 3 years old and the largest specimens found to be 4 years old. This means the species spawns more than once during its life, but does not reach first maturity until the end of second year of life in the case of the fish, *Garra lamta*. Mostly both the ovaries of *Garra lamta* were equal in length but few specimens' unequal length of ovaries was also recorded by Pathani (1981).

The sexual dimorphism in different fishes have been reported by Joshi and Pathani (2009) and Conway and Britz (2007). The male and female fishes can be identified very easily with the help of some discernible characters as also reported by McBride and Johnson (2007) and Joshi and Pathani (2009). The stimuli of the onset of reproduction in any hill stream are reported as multiple factors (Temperature, water discharge, pH and D.O.) come together and provide a favourable condition to the fishes to spawn (Joshi and Pathani, 2009, Shamsan, 2008; Sahai, 1998; Singh *et al.*, 2008 and Kumar *et al.,* 2006). The percentage frequency of mature gonads was higher during May-June and spent individuals were also noticed in next to the spawning part of the year i.e. July and August. This suggests that *Garra lamta* has a spawning season extending from April to June in a year. The highest spawning activity was observed during May and June in female and April-May in male. In the present study, high values of GSI denoted attainment of peak maturity of gonads. These observations corroborate the earlier reports on *Sillago sihama* (Shamsan, 2008); *Barilius bendelisis* (Dobariyal and Singh, 1989), *Botia dayi* (Kumar *et al.*, 2006) and European hake (Murua and Motos, 2006). The gonado somatic index was being maximum during the ripe phase of the fish and declining abruptly after spawning activity. The first maturity length group for spawning of fish ranged from 8.2cm to 13.0cm in total length in both male and female *Garra lamta.*

The population size stock from catch data either it is from hand catch and cast netting or by other means were studied for *Garra lamta* from Petsal and Sironia garh of Suyal river of Kumaun Himalaya. The catch data showed fishes of mostly one to four year of age in the river. Fish catch size and age data analysis show that mature fishes are caught by various means during breeding season. Breeding season fishing is one of causes of decline of *Garra lamta* in the waters. The fishes in the age group of 3 years dominate the fish population of the Petsal and Sironia garh of Suyal river. Pathani (1984) has also reported high fluctuations in size and age in the case of mahaseer..

Sex ratio indicates the possibility of fertilization in fishes, which is fluctuating month wise in the case of *Garra lamta* in the study. The sex-ratio deviation in fishes happens because of differential behaviour of sexes, environmental conditions and fishing in the case of *Garra lamta* in the present study. It has been also observed that the female are more than male during spawning season in the catch in the study. Similar observations were also made by Pathani (1984), Gaur and Pathani (1996) Singh and Lakra (2000) Musa and Bhuiyan (2007) and Kumar *et al.,* (2006). Sex ratio in between male and female may be more than one indicated more chances of fertilization in the case of fishes (Nikolsky, 1999) which is not happening in the case of *Garra lamta*. It indicates that low chance of fertilization in *Garra lamta*. This also may be responsible for low production of the fish in the water.

Acknowledgements

The author is thankful to the Head, Department of Zoology, Kumaun University, Soban Singh Jeena, Campus, Almora for providing necessary facilities during the period of study.

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