Journal of Fisheries & Livestock Production

Dwivedi and Mayank, J Fisheries Livest Prod 2017, 5:1
DOI: 10.4172/2332-2608.1000212

Research Article Open Access

Reproductive Profile of Indian Major Carp, *Cirrhinus mrigala* (Hamilton, 1822) with Restoration from the Ganga River, India

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Abstract

Information of sex ratio is considered vital in the management of the fisheries as it enables to follow the movement of the sexes in relation to the season in life cycle. Present study was undertaken between the months of March 2014 to February 2015 from the middle stretch of the Ganga river, India. 423 fish specimens were examined of *Cirrhinus mrigala* for determination of sex ratio and sex structure from the Ganga river, India. Male proportion was higher than female in 19.1-25.0, 25.1-31.0, 31.1-37.0, 85.1-91.0 and 91.1-97.0 cm size groups. Proportion of male and female was recorded equal in 79.1-85.0 cm size groups. In the stock, female proportion was higher than male (1:1.05). It is very close to equal proportions of male and female (1:1). It did not differ significantly. In the stock, sex structure of male and female was recorded 48.70% and 51.30, respectively.

Keywords: Size composition; Sex ratio; Sex structure; *Cirrhinus mrigala*; Ganga river

Introduction

Riverine fisheries are important as it provides nutritional food security and employment for millions of people around the world [1-4]. Fisheries management system is based on the principle of the sustainable use of a renewable living resource. *Cirrhinus mrigala* shares a good production in commercial catches of the rivers Ganga, Yamuna, Brahmaputra, Godavari and other tributaries [5-9] and economically important fish species for the nations i.e. India, Bangladesh, Nepal and Pakistan. Now-a-days *C. mrigala* over exploited in the Ganga river system [3]. The raised fishing stress due to greater demand for fish and fish product, followed by indiscriminate fishing techniques increased the fishing effort leading to the under/over exploitation, which steadily led to a fall in the catch per unit effort. With the decreasing natural stocks the fishermen had to increase fishing effort for whatever species or size of fish were available to support their livelihoods.

It is a very fast growing and large sized carp species [10,11] and commonly known as Mrigala/Nain. Freshwater rivers, reservoirs, jheels, tanks and beels are the natural habitats of mrigala. It is an excellent species for pond culture in India, Burma, Bangladesh, Nepal and Pakistan [12,13]. *C. mrigala* is a backbone of culture fishery practices in the India and Bangladesh with *Cyprinus carpio, catla catla* and *Labeo rohita* [1,6,11,14]. Its growth, recruitment and survival are suffered in polluted water (e.g. heavy metals concentrations) [3]. Today, most running water systems are in a deplorable state [15]. In general, heavy metal pollution is very harmful for gonadal development and fecundity of fishes [16,17]. The environmental conditions are not static and human influence has greatly stimulated the flow of environmentally deleterious changes by loading with chemicals to the aquatic system [18-20].

Sex ratio is helpful in understanding the recruitment of fishes in population [21]. The sex ratio in the spawning population and in the various age and size groups varies with the species, reflecting the relationship of that species to its environment. The concept of 1:1 sex ratio was conformed in river ecosystem [21-27].

Martial and Methods

The River Ganga is the most important river system in India. It is largest river system in India. It originates from the Gangotri glacier at Gomukh, at an altitude of about 6000 m in the Garhwal Himalaya, India. The Ganga river is about 2525 km long, covering a basin area of 861,404 km^2. The Ganga river system drains about one fourth of the Indian subcontinent and different geographical eco-region. The river supports abundant biological wealth, characterized by its rich fisheries, faunal and floral biodiversity. The Ganga river at Allahabad is mainly using for vegetable crop and wheat crop in winter and summer seasons. Agricultural use still produces large amounts of eroded fine particles that threaten biodiversity globally [28]. The 423 fish samples of *Cirrhinus mrigala* were collected at random during March 2014 to February 2015 from the middle stretch of the Ganga river (Teliyarganj fish market), India. This market represents the fishes of middle stretch of the Ganga river at Allahabad. Size of fishes was measured by simple measuring scale. Total length (TL) of fishes was measured from tip of the snout to the largest fin rays of caudal fin. Collected data were classified at 6.0 cm intervals and size composition varied from 19.2 to 92.4 cm size groups. The number of samples calculated according to size group and converted into percentage.

Results and Discussion

The size composition of *C. mrigala* varied from 19.2 to 92.4 cm of total length. Female proportion was higher than male in 37.1-43.0, 43.1-49.0, 49.1-55.0, 55.1-61.0, 61.1-67.0, 67.1-73.0 and 73.1-79.0 cm size groups (Table 1). In case of mature stock, female fishes were dominant compared to male from the Ganga river at Allahabad. Male proportion was higher than female in 19.1-25.0, 25.1-31.0, 31.1-37.0, 85.1-91.0 and 91.1-97.0 cm size groups. The sex ratio was observed to be 1:0.89, 1:0.88, 1:0.96, 1:1.09, 1:1.12, 1:1.17, 1:1.21, 1:1.25, 1:1.33, 1:1.37, 1:0.57 and 1:0.50 in and 1.0:1.2 in fishes 19.1-25.0, 25.1-31.0,

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Received November 24, 2016; **Accepted** December 28, 2016; **Published** January 13, 2017

Citation: Dwivedi AC, Mayank P (2017) Reproductive Profile of Indian Major Carp, *Cirrhinus mrigala* (Hamilton, 1822) with Restoration from the Ganga River, India. J Fisheries Livest Prod 5: 212 doi: 10.4172/2332-2608.1000212

Size ranges (cm)	Number of male	Number of female	Sex ratio
19.1-25.0	18	16	1:0.89
25.1-31.0	25	22	1:0.88
31.1-37.0	26	25	1:0.96
37.1-43.0	34	37	1:1.09
43.1-49.0	25	28	1:1.12
49.1-55.0	18	21	1:1.17
55.1-61.0	14	17	1:1.21
61.1-67.0	12	15	1:1.25
67.1-73.0	9	12	1:1.33
73.1-79.0	8	11	1:1.37
79.1-85.0	8	8	1:1.0
85.1-91.0	7	4	1:0.57
91.1-97.0	2	1	1:0.5
Stock	206	217	1:1.05

Table 1: Sex ratio of *Cirrhinus mrigala* (Hamilton, 1822) from the Ganga river.

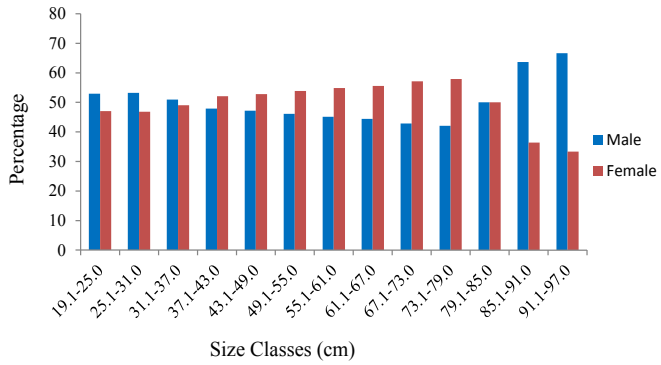

Figure 1: Sex structure of *Cirrhinus mrigala* from the Ganga river, India.

31.1-37.0, 37.1-43.0, 43.1-49.0, 49.1-55.0, 55.1-61.0, 61.1-67.0, 67.1-73.0, 73.1-79.0 85.1-91.0 and 91.1-97.0 cm size groups, respectively. Study also showed that the female fishes more active in the Ganga river ecosystem. Proportion of male and female was recorded equal in 79.1-85.0 cm size groups (Table 1). In the stock, female proportion was higher than male (1:1.05). It is very close to equal proportions. It did not differ significantly.

The sex structure of male fish was maximum in 91.1-97.0 cm size group (66.67) and minimum in 73.1-79.0 cm size group (42.10%). The sex structure of female fish was maximum in 73.1-79.0 cm size group (57.90%) and minimum in 91.1-97.0 cm size group (33.33%). The sex structure of male and female both was recorded similar in 79.1-85.0 cm size groups (Figure 1). In the stock, sex structure of male was recorded (48.70%) and female (51.30%). It is also good indicator of heavy recruitment in breeding season.

Mayank et al. [23] reported that the female ratio was dominated in *L. calbasu* from the Ghaghra river. The over all sex ratio is close to 1.0:1.0 in many species, but it may be far from this in particular age and size groups, males usually predominating in the younger groups, because they mature earlier but live less long [22,29]. Water flow and depth of rivers are also responsible of changing sex ratio specially in breeding season [30] and over exploitation [31,32]. Higher proportion of female was observed in the stock of *Cirrhinus mrigala*, sex ratio of male and female was 1:1.05 from the Yamuna river [27]. Dwivedi, et al. [24] reported that the sex ratio of *Labeo rohita* dominated by male fishes from the Vindhyan region. It may be concluded that the sex ratio and sex structure of *C. mrigala* stock indicated positive recruitment in the Ganga river, India.

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