Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic
Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 10 (4): 294-299, 2015
ISSN 1816-4927 / DOI: 10.3923/jfas.2015.294.299

Reproductive Biology of Great Snakehead *Channa marulius* from Sylhet Basin in the North East Bangladesh

[1]Arafat Siddiquee, [1]Harunur Rashid, [2]Md. Ariful Islam, [2]Khan Kamal Uddin Ahmed and [1]Md. Shahjahan

[1]Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, 2202, Bangladesh
[2]Bangladesh Fisheries Research Institute, Shrimp Research Station, Bagerhat, Bangladesh

Corresponding Author: Md. Shahjahan, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, 2202, Bangladesh

ABSTRACT

The reproductive biology of an endangered fish species great snakehead (*Channa marulius*) was studied by gonadosomatic index (GSI) and histological analysis of ovaries and testis. Fishes were collected from the haor areas of greater Sylhet basin for a period of July 2011 to June 2012. For female the highest GSI (0.42) was in July and the lowest (0.018) was in January and March. Similarly, for male the highest GSI (0.056) was in July and the lowest (0.018) was in January. In the histological study, the premature (PM) and mature (M) stages of oocytes were observed in the ovaries of fish collected in June to July. The ovaries contained developing oocytes oogonia (OG) and perinuclear oocytes (PNO) in the August and subsequent month samples which were mostly spent. In testis high proportions of mature germ cells spermatids (SPT) and spermatozoa (SPZ) were observed in the July samples of *C. marulius*. In parallel to GSI, both the ovary and testis develop and mature synchronously. The present findings indicated that *Channa marulius* from Sylhet basin attains peak reproductive maturity in the month of June and July which revealed the breeding season of this species.

Key words: Gonadosomatic index, histology, gajar, reproduction, haor

INTRODUCTION

Aquatic biodiversity has been declined significantly due to manmade and natural causes in Bangladesh (Shahjahan *et al*., 2001). Among the total 267 fish species, 54 are endangered condition where 12 species are critically endangered, 28 species are endangered and 14 species are vulnerable (IUCN Bangladesh, 2003). Among these fish species, gajar, *Channa marulius* (great snakehead) is in endangered condition. However, it is one of the important zeol (air breathing) fishes of Bangladesh with good market demand and an important source of proteins, fat, vitamins, minerals, iron and calcium (Thilsted *et al.,* 1997). Moreover, the fish is very important for commercial aquaculture, game fishing and aquarium fish culture. Therefore, it is important to save this fish from endangered condition. Knowledge on reproductive biology of fish is essential for evaluating the commercial potentialities of its stock, life history, culture practice and management of its fishery. Studies on reproductive physiology, on the other hand, can also provide important and basic information on the gonadal maturity, breeding potential and breeding season of a species. Information on reproductive physiology is particularly important for threatened fish species concerning conservation. In Bangladesh, there is limited knowledge about stocks, habitats,

behavior, reproduction, spawning etc. of important fish species which are required for their conservation, sustainability, management in the nature. In fish, GSI and gonadal histology are important tools to identify the breeding season. In parallel to GSI and gonadal development several neurohormones, gonadotropins and steroid hormones have been elevated in several fish species (Shahjahan *et al.,* 2010a, b, 2011; Shahjahan and Ando, 2011; Ando *et al.,* 2013). Therefore, GSI and gonadal histology serves as basic information to select the inducing agents, brood fish and timing for induced breeding. Towards this venture, the preliminary information generated on the reproductive biology from GSI and histological observation of *C. marulius* gonads (oogenesis and spermatogenesis) can serve as the base for further research on *C. marulius* with an aim of establishing the package of induced breeding and to management and conserve from threatened condition. The purpose of this study is to examine the reproductive biology of great snakehead by GSI and histological analysis of testis and ovaries.

MATERIALS AND METHODS

Samples of *Channa marulius* were collected from different haor areas of Sylhet division every month starting from July 2011 to June 2012. The male and female fishes were identified by observing the gonads with naked eyes. Then ventral side of the samples were cut and opened from the anus towards the lower jaw by using scissors carefully. The gonadosomatic index (GSI) was calculated as the ratio of Gonad Weight (GW) and Body Weight (BW) in percentage by following equation:

$$GSI = \frac{GW}{BW} \times 100$$

Ovaries and testis belonging to a range of developmental stages were prepared for histological study by fixing in 10% formalin, washing in running water and storing in 70% alcohol until sectioning. Examination of cross section from different parts of ovaries and testis were prepared and finally observed microscopically to take perfect picture. Those sections were dehydrated in a graded series of alcohol, cleared in chloroform, embedded in paraffin, trimmed by using sharp knife, sectioned by using microtome blade in microtome machine at 3-4 μm. The sections were fixed on glass slides with Mayer's fluid, stained routinely with haematoxyline and eosin following the standard histological procedure, mounted in mounting agent like DPX and examined to identify the gametogenic cell types.

RESULTS

Gonadosomatic index (GSI): The monthly GSI values of *Channa marulius* were ranged from 0.018-0.42 and 0.018-0.056 in female and male, respectively during the study period (Fig. 1a-b). The highest GSI value of both female (0.42) and male (0.056) were observed in July.

Oocytes stages in female: In the microscopic observation of the ovaries section the following stages were observed in the ovary of *Channa marulius* as follows: M, mature and UO, undeveloped oocytes in July samples (Fig. 2a), LYG, Late Yolk Granule and LPNO, late perinuclear oocyte stages in August samples (Fig. 2b), UO, undeveloped oocyte; YV, yolk vesicle and EPNO, early perinuclear oocyte stages in October samples (Fig. 2c); UO, undeveloped oocyte; EPNO, early perinuclear oocyte; LPNO, late perinuclear oocyte and YG, yolk granule stages in November

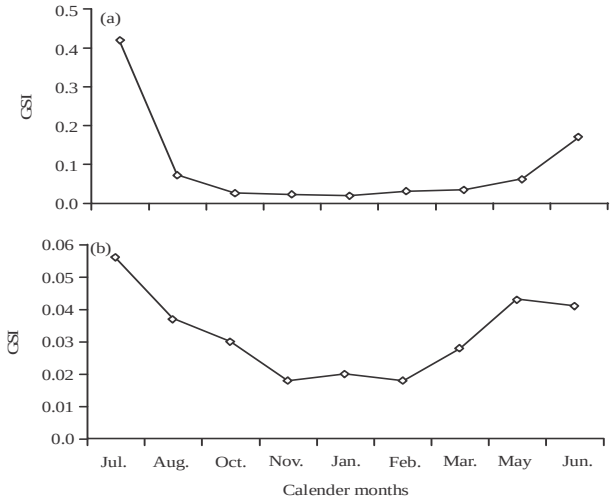

Fig. 1(a-b): Monthly mean gonadosomatic index of (a) Female and (b) Male *Channa marulius*

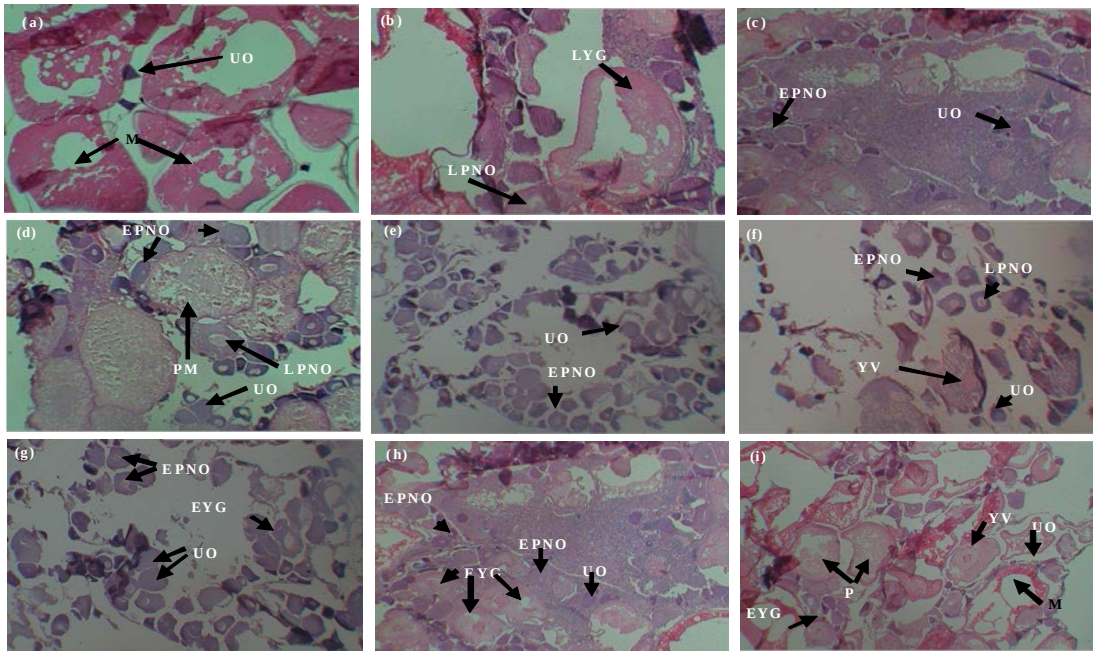

Fig. 2(a-i): Haematoxylin-eosin stained sections of *Channa marulius* ovary at 10× magnification. Ovary sampled in (a) July, 2011, (b) August, 2011, (c) October, 2011, (d) November, 2011, (e) January, 2012, (f) February, 2012, (g) March, 2012, (h) May, 2012 and (i) June, 2012 and M: Mature stage, PM: Pre-mature stage, UO: Undevelop Oocyte, LYG: Late yolk granule, EPNO: Early perinuclear oocyte, LPNO: Late perinuclear oocyte, YV: Yolk vesicle stage, YG: Yolk granule stage

samples (Fig. 2d); UO, Undeveloped Oocyte; EPNO, Early Perinuclear Oocyte and EYG, Early Yolk Granule stages in January samples (Fig. 2e); UO, undeveloped oocyte; EPNO, early perinuclear oocyte; LPNO, late perinuclear oocyte and YV, Yolk Vesicle stages in February samples (Fig. 2f);

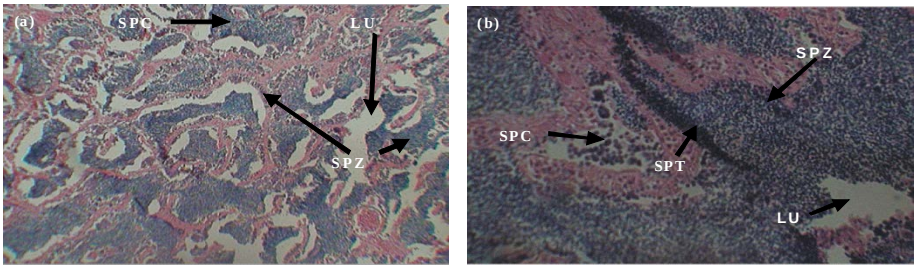

Fig. 3(a-b): Haematoxylin-eosin stained sections of *Channa marulius* testis at (a) 10× and (b) 40× magnification in July, 2011. SPC: Spermatocytes, SPT: Spermatids, SPZ: Spermamatozoa, LU: Lumen

UO, undeveloped oocyte; EYG, early yolk granule and EPNO, early perinuclear oocyte stages in March samples (Fig. 2g); UO, undeveloped oocyte; EPNO, early perinuclear oocyte; EYG, early yolk granule and YV, yolk vesicle stages in May samples (Fig. 2h) and UO, undeveloped oocyte; EPNO, early perinuclear oocyte; LPNO, late perinuclear oocyte; EYG, early yolk granule; YV, yolk vesicle; M, mature and PM, pre-mature stages of oocytes in June samples (Fig. 2i).

Testicular germ cells of male: In the microscopic observation of the testis section the following stages were observed in the testis of *Channa marulius* as follows: SPC (spermatocytes), SPT (spermatids), SPZ (spermatozoa) and LU (lumen) were observed in July sample. The SPZ were highest in number (Fig. 3a-b).

DISCUSSION

Gonadosomatic index (GSI): The GSI increases with the maturation of fish, being maximum during the period of peak maturity and declining abruptly thereafter, when the fish become spent (Le Cren, 1951). In the present study, the highest GSI values of both male and female in July indicates that both sexes mature synchronously and the breeding season of *Channa marulius*. Similar observations were recorded by Sindhe and Kulkarini (2004) in *Notopterus notopterus*, Brewer *et al*. (2008) in small riverine fishes, Akter (2011) in female *Pangasiu spangasius* and Maya (2011) in *Mystus cavasius*, where they found the highest GSI in July.

Ovarian stages: In the present study, premature (PM) and mature (M) stage oocytes were found in fish ovary from June to July samples, The ovaries contained developing oocytes oogonia (OG), perinuclear oocytes (PNO) in August samples, indicating spent phase of ovary. In a similar study with *Mystus cavasius,* it was observed that the PM and M oocytes were found from early July to August samples of ovary, indicating the spawning season of *Mystus cavasius*. The ovaries contained developing oocytes oogonia (OG) and perinuclear oocytes (PNO) in post-monsoon September samples, indicating spent phase of ovary (Maya, 2011). In a study with *Pangasiu spangasius*, it was observed six stages of gradually maturing oocytes, *viz.*, UO, PNO, PVO, vitellotenic oocyte at vesicle breakdown stages (VO-vb), vitellotenic oocyte at vesicle hydration stages (VO-h) in ovary, sampled from captive fish during May to October. The breeding season of this fish was observed during May to August and peak breeding was in July (Akter, 2011), which is similar with present study.

Testicular stages: Testicular stages in *Channa marulius* were studied only in the month of July following the maximum mature oocytes in ovary of July sample. However, spermatocytes (SPC),

spermatids (SPT), spermatozoa (SPZ) and also empty lumen of tubules (LU) germ cell stages were observed in the testis, though SPT and SPZ were in high proportions. Similarly, SPT and SPZ were observed in testis of *Mystus cavasius* during July to August (Maya, 2011), which is similar with the present study. In another study with *Ompok pabda*, it was observed large amount of SPT, SPZ and small amount of SPC in the testis during April to July (Alam, 2009).

CONCLUSION

Great snakehead, *Channa marulius* is one of the most important indigenous fishes in Bangladesh which has been listed as endangered species. To conserve the species, it is important to take steps for gathering reproductive biological knowledge of this fish species. In the present study, reproductive biology of *Channa marulius* was studied by GSI and histological analysis of ovaries and testis. In parallel to GSI both the ovary and testis develop and mature synchronously, attains peak reproductive maturity in the month of Juneand July.

ACKNOWLEDGMENTS

This study was supported by the grants from BAURES and IDRSBFRI project of Bangladesh Fisheries Research Institute.

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