Annual Changes in the Ovary of Xenentodon Cancila (Ham.)

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ABSTRACT

The gonads of Xenentodon cancila show well marked changes in their morphological (shape, size and volume) and histological features during different months of the reproductive cycle. On the basis of these changes, the reproductive cycle is divided into spawning (May to September), post-spawning (October to December) and pre-spawning periods (January to April). In the present study ten cytological stages in the development of oocytes have been observed in the ovary which are early and late chromatin-nucleolus stages, early and late peri-nucleolus stages, early and late yolk-vesicle stages, early and late yolk stages, pre-maturation stage and the mature stage. Besides these different oogenetic stages, Corpora atretica and post-ovulatory follicles are also present in the ovaries. The quantitative study of reproductive cycle of Xenentodon cancila has been made in respect of gono-somatic index during different months of the year. Although this study, regarding the gono-somatic index, is approximate, yet it is quite significant in understanding the gonadal cycle and seasonal changes in the gonads.

Key words: Seasonal change, Ovary, reproductive cycle, Xenentodon Cancila

1. Introduction

In most of the teleost, it has been well established that the ovary undergoes fairly regular seasonal changes and it has been demonstrated in a score of oviparous and viviparous species by several investigators. Most fish species have definite seasons for spawning as a part of their timed reproductive relationships and are generally grouped as warm water fishes and summer spawners and cold water fishes. Species tolerating intermediate temperature are generally spring spawners. Some tropical species spawn the year around. Fixed spawning reasons are roughly correlate with the development period that the fish requires (Lagler et al., 1977). The breeding season and the spawning reflex, however, vary interestingly in different species and various internal and external factors have been considered responsible for this variation in spawning behaviour.

2. Materials and methods

Monthly collections of fish were made for one complete year (2007-2008) and a total of 10 specimens were observed every month. Length and weight of each individual and ovaries were recorded and gono-somatic index was calculated from this data. Fixation of upper, middle and lower portions of gonads was done usually in Bouin’s fluid and Smith’s bichromate formol. Fixed material was cut at 6-10µ and stained with iron-haematoxyline,
counterstained by eosin. Ova diameter measurements were made on lamameter on sampling basis.

3. Results

3.1 Morphology

The gonads of *Xenentodon cancila* are small paired structures which lie posteriorly in the body cavity ventral to the air bladder. Both halves of the gonads are in close contact with each other. The right half is always slightly larger in size. The gonads open into a common gonoduct posteriorly. The gonoduct and the kidney duct open together in the urinogenital sinus which opens outside behind the anal opening through the urinogenital aperture. The ovary is covered with a thin sheath of peritoneal membrane below which lies the ovarian wall which consists of an outer layer of connective tissue and blood vessels and an inner layer of germinal epithelium. The ovarian wall projects inwards forming ovigerous lamellae containing different stages of developing oocytes. In the present study ten cytological stages in the development of oocytes have been observed in the ovary which are early and late chromatin-nucleolus stages, early and late peri-nucleolus stages, early and late yolk-vesicle stages, early and late yolk stages, prematuration stage and the mature stage (Figures. 1, 2, 3, 4, 5). Besides these different oogenetic stages, Corpora atretica and post-ovulatory follicles are also present in the ovaries. When the immature oocytes fail to attain maturity at any stage of development or when mature oocytes fail to spawn, they result in the formation of Corpora atretica. The Corpora atretica, thus formed, undergo various stages of resorption until they are completely lost in the ovarian tissue. The post-ovulatory follicle is a mass of follicular cells left behind after the extrusion of mature oocyte from the ovarian follicle. The post-ovulatory follicles undergo gradual degeneration and finally get absorbed in the ovarian stroma.

The gonads of *Xenentodon cancila* show well marked changes in their morphological (shape, size and volume) and histological features during different months of the reproductive cycle. On the basis of these changes, the reproductive cycle is divided into spawning, post-spawning and pre-spawning periods. Since the fresh reproductive cycle begins at the end of the spawning period, it has been described first in the following account.

(a) Spawning period (May to September)

During this period, the ovaries are large in size, beaded in appearance and orange in colour. In the month of July, the ovarian wall is thin and the ovigerous lamellae lose their identity. The ovary is closely packed with oocytes of yolk stage, prematuration stage and mature stage. In the month of August and September, the ovarian wall is thick, the ovigerous lamellae begin to reappear and the ovary is loosely packed with all the stages of oogenesis. The number of corpora atretica increases during this period while few post-ovulatory follicles are first located in the month of May and their number increases considerably till the end of the spawning period (Figure 6).

(b) Post-spawning period (October to December)

During these months, the ovaries are thin, small in size and smooth in appearance. They are yellowish in colour. The ovarian wall is thick and ovigerous lamellae are distinct containing oocytes of chromatin-nucleolus and peri-nucleolus stages. The corpora atretica are few in number. The post-ovulatory follicles are not present except in the ovary of one of the specimen collected in October where they are few (Figure 2).
(c) Pre-spawning period (January to April)

The ovaries in the pre-spawning period are small and cylindrical in shape. They are smooth in appearance and yellowish in colour. In June, the ovaries of few fishes have a little granular surface. In the ovaries of January, February and March, the ovarian wall is thick. The ovigerous lamellae are distinct and contain oocytes of early and late yolk-vesicle stages alone with the oocytes of the early stages (Figure 3). In the ovaries of April, few oocytes of early and late yolk stages, varying in number from a very few to many, are also present. Few corpora atretica have been observed during this period, while post-ovulatory follicles are absent (Figure 4).

3.2 Quantitative study of the reproductive cycle

The quantitative study of reproductive cycle of *Xenentodon cancila* has been made in respect of gono-somatic index during different months of the year. Although this study, regarding the gono-somatic index, is approximate, yet it is quite significant in understanding the gonadal cycle and seasonal changes in the gonads.

3.3 The changes in the volume of ovaries and the gonado-somatic index of the female fish

Gonado-somatic index (GSI) of female *Xenentodon cancila* was recorded in every month of the study period. The results are tabulated in (table 1). During the spawning period (May to September), the average values for the ovarian volume and the gono-somatic index show a gradual increase till they attain the peak in the month of July and then onwards these values gradually decrease. It indicates the high metabolic activity of the fish during this period and the maximum spawning of the fish takes place in August and September.

During the post-spawning period (October to December), the average volume of the ovaries and the average gono-somatic index of the female fish decreases gradually which justifies the gradual shrinkage in the ovaries during this period. It indicates that during this period, the metabolic activity of the fish becomes low after spawning.

During the pre-spawning period, the average values for the ovarian volume and the gono-somatic index are observed in an increasing order. It indicates that the ovaries are in active state during this period and the process of oogenesis has been accelerated.

4. Discussion

Under present investigations, seasonal changes in the gonads have been studied on the basis of morphological and histological structure, rise and fall in the gonado-somatic index of *Xenentodon cancila*. Raizada (1975, 1977) has observed that the spawning period of *Nandus nandus* extends for a pretty long period of six months from April to September. However in case of present fish, the spawning period is found to be extending from May to September.

In the present work, the reproductive cycle has been assessed on the basis of morphological and histological changes taken place in the gonads so as to correlate it with the seasonal changes in the reproductive system of the fish. The gonads of *Xenentodon cancila* are small paired structures which lie posteriorly in the body cavity ventral to the air bladder. Both halves of the gonads are in close contact with each other. The right half is always slightly larger in size. The gonads open into a common gonoduct, posteriorly. The common gonoduct
and the common urinary duct open together in the urinogenital sinus which opens outside behind the anal opening through a common urinogenital aperture.

According to Marza (1938) the developing rhythm of Oocytes may be classified into three groups, the total synchronism, group or partial synchronism and asynchronism. The first group in which all oocytes in an ovary develop synchronously includes Oncorhynchus masou Yamamoto et al., (1959), which spawns only once in life and dies soon after. The second category is common among fishes such as herrings (Hickling and Rutenberg, 1936) and speckled trout (Vladykov, 1956). In these species two groups of oocytes are sharply marked indicating spawning once a year with a short and definite season. In these species several batches of oocytes in different stages are present indicating a long spawning season and several spawning within a season.

![Figure 1: showing early yolk stages 28X (arrow)](image1)

![Figure 2: Showing oocytes of early and late yolk stage 28X (arrow)](image2)
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Figure 3: Showing oocytes of chromatin-nucleolus and peri-nucleolus stages 28X (arrow)

Figure 4: showing seminiferrous tubules partially filled with spermatozoa 400X (arrow)

Figure 5: Showing oocytes early and late yolk stages 28X (arrow)
In *Xenentodon cancila*, ten cytological stages in the development of oocytes have been observed in the ovary which are early and late chromatin-nucleolus stages, early and late peri-nucleolus stages, early and late yolk-vesicle stages, early and late yolk stages, prematuration stage and the mature stage. The dominance of every stage varies depending on the maturity of the ovary.

Gonado-somatic index (GSI) of *Xenentodon cancila*, collected from Lower Lake was studied. Cyclic changes in the weight of the gonads (ovary and testis) have been observed depending on various phases of spawning period.

5. References


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