

## SEASONAL CHANGES IN THE OVARY AND PAS +VE CYANOPHILS OF THE PITUITARY IN *CHANNA STRIATA* BL. (TELEOSTEI)

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### Abstract

The ovarian cycle of snake-head, *Channa striata* is divisible into, (i) Pre-spawning (Mar.-May); (ii) Spawning (Jun.-Aug), (iii) Post-Spawning (Sep.-Nov.) and (iv) Preparatory (Dec.-Feb.) seasons. The co-relative changes of PAS +ve cyanophils of the pituitary gland parallel the fluctuations of gonosomatic index (GSI) and the ova diameter. During pre-spawning season, a quantitative increase in PAS +ve cells and their secretory activity is followed by increase in ovarian weight and vitellogenesis. The peak of GSI (6.4) and ova diameter (1.12mm) occurs in June, when the spawning begins. Oogenesis commences in September when the activity of PAS +ve cells is at the lowest level. Ovarian recrudescence starts in February and the process of vitellogenesis continues during pre-spawning season. The pattern of oocyte growth in *C. striata* is "Group Synchronous" type. Seasonal changes in PAS +v cyanophils during different phases of ovarian maturity indicate their gonadotropic role. This information may prove quite useful for the artificial culture of this species.

### Introduction

The snake-head, *Channa striata* is one of the important commercial fresh water fishes of Pakistan. The information in regards to seasonal reproductive cycle of fishes from this region is very little. Seasonal cycles of gonadal development have however been studied in a number of teleost fishes from temperate region, such as fat-head minnow, *Pimephales promelas* (Smith, 1978); dab, *Limanda limanda*

(Htun-Han, 1978); rainbow trout, *Salmo gairdneri* Van Den Hurk and Peute 1979) and roach, *Rutilus rutilus* (Jafri, 1980). Seasonal development of gonads has also been studied in a few tropical species such as, *Heteropneustes fossilis* (Ghosh and Kar, 1952); *Barbus stigma* (Sathyanasen, 1961); *Ophiocephalus punctatus* (Belsare, 1962) and *Cyprinion watsoni* (Sheikh and Jalali, 1991). Like other vertebrates, in fish as well, the gonadotropic hormones control the reproductive function (Pickford and Atz, 1957). Various studies of pituitary cytomorphology (Sage and Bern, 1972; Schreibman *et al.*, 1973 and Jafri, 1985) have indicated that the production of gonadotropins is the function of PAS +ve cyanophils.

Few attempts have been made in the past to correlate the seasonal changes in pituitary cytology with various stages of the reproductive cycle in fishes. Such information is available with regards to a few species e.g. *Carassius auratus* (Beach, 1959); *Heteropneustes fossilis* (Sundraraj, 1959); *Mystus vittatus* (Sathyanasen and Singh, 1962); *Salmo gairdneri* (Robertson and Wexler, 1962); *Tor tor* (Rai, 1966) *Labeo rohita* (Sen, 1972). These studies are consistent with the observation that the cyclical changes in gonads are dependant upon the changes in secretory activity of PAS +ve cyanophils of the pituitary.

Keeping in view of the commercial importance of *Channa striata*, seasonal changes of the ovary and the pituitary have been studied in this species.

### Material and Methods

For this investigation live fishes were brought to the laboratory from Thatta district of Sindh. Only mature fish were used in this study. Each month the data of length and weight for atleast five fishes was recorded for one year. Fish were killed by decapitation. Ovaries were extirpated and weighed to nearest milligramme. Small pieces from anterior, middle and posterior portion of the ovary were fixed in Bouin's fluid (Gurr, 1956) and processed for microtomy by usual paraffin method. Sections cut at 5 $\mu$ m were stained with Delafield's Heamatoxylin. The ovarian weight was recorded in the form of "Gonosomatic Index" (GSI=Wet weight of Ovary/Body Weight  $\times$  100). Oogenesis was studied according to the stages proposed by Yamazaki (1965). Pituitary sections were prepared according to the method by Jafri (1985). The PAS +ve cyanophils of the pituitary were recorded from the sagittal sections as percentage by using a graticule.

## Results

Ovaries in *C.sriata* are paired, elongated structures, which are suspended from the body wall by mesovarium. The ovaries taper at both ends and are joined posteriorly to form a thin walled oviduct, opening on the urino-genital papilla. Ovarian tunic consists of a thin outer peritonium and a thick layer of connective tissue. The ovary contains a distinct central lumen, which is surrounded by many ovigerous folds. As the oocytes develop and grow in these folds, the ovarian lumen is gradually reduced.

Seasonal changes of the ovary and pituitary cells have been studied under following phases:

- (i) *Pre-spawning Season (March-May)*: During this season the ovaries show a rapid increase in weight (Fig.1), which coincides with the increasing water temperature of summer. Ova diameter increases upto 0.8mm by May. The colour of ovaries changes from light pink to light yellow. Ovary is characterised by the presence of numerous large and small ova. Vitellogenesis is in progress in oocytes of primary and secondary yolk stages. In larger oocytes, the yolk vesicles develop from the periphery and filled the whole ooplasm. Afterwards, the yolk granules appear among the vesicles. At this time, granulosa and zona radiata layers are also visible in the follicular wall of the oocytes. The PAS +ve cells of the pituitary also increase in number during this season and reach their peak in April (Fig.1). These cells are filled with coarse secretory granules and show some vacuolation.
- (ii) *Spawning Season (June-August)*: The spawning coincides with summer monsoon rains. The GSI shows its peak (6.4) in June (Fig.1) and gradually decreases to 0.6 in August. Ovaries in June occupy the whole abdominal cavity, and are bright orange in colour. Large oocytes are visible to naked eye through the thin ovarian tunic. The ovary at this time is filled with large yolky oocytes. Largest ova diameter is attained in June (1.12 mm). The spawning, which is evident by the presence of empty follicles in the ovary, continues through this season. By the end of August, the ovaries show completely spent condition. Such ovaries contain only small oocytes in peri-nucleolus stage. A few atretic oocytes are also visible among the empty follicles of the ovary. The PAS +ve cells of the pituitary also decrease during this season.
- (iii) *Post-Spawning Season (September-November)*: Ovaries remain small and shrivelled and are pink in colour. Outer tunic of the ovary is thick and the

lumen is conspicuous at this stage. A number of Oogonial cysts appear in the ovigerous folds, which contain very small oocytes in chromatin nucleolus stage. These oocytes increase in number and soon develop into peri-nucleolus stage (0.6 mm). No appreciable change occurs in the GSI, while the PAS +ve cells of the pituitary are reduced to the lowest level of activity (Fig.1).

- (iv) *Preparatory Season (December-February)*: Ovarian recrudescence begins in this season and the GSI shows an increasing trend. Majority of oocytes are in early and late peri-nucleolus stage, their diameter being increased upto 14 mm (Fig.1). Few large oocytes show a ring of yolk vesicles at the periphery. The PAS +ve cells of the pituitary, start increasing in number during this season.

### Discussion

The ovaries of *C.striata* exhibit striking seasonal changes in weight, morphology and cytology. Similar ovarian cycles have been studied in a number of temperate and tropical fish species, such as, *Gasterosteus aculeatus* (Craig-Bennet, 1931), *Fundulus heteroclitus* (Matthewo, 1938) and *Heteropneustes fossilis* (Ghosh and Kar, 1952). At the time of maturation, oocyte clutches of various sizes have been observed in *C.striata*, which suggest a protracted spawning season, like other batch-spawners. This condition corresponds to, " Group Synchrony" as proposed by de Valaming (1983).

Few attempts have been made in the past to correlate the seasonal cytological changes of the pituitary and corresponding changes in gonads of fish, such as, *Carassius auratus* (Beach, 1959), *Labeo rohita* (Sen, 1972) and *Channa striata* (Jawaid and Gul-e-Nargis, 1974).

such studies consistently indicate that only the PAS +ve cyanophils of the pituitary gland fluctuate in quantity and secretory activity in relation to the reproductive cycle (Sathyanasen and Singh, 1962; Rai, 1966).

In *C.striata*, PAS +ve cells of the pituitary exhibit distinct seasonal changes in quantity and secretory activity, which parallel the maturation season (April) and is reduced to minimum level during post-spawning season (October). Similar seasonal changes have been observed in the pituitary of rainbow trout, *Salmo gairdneri* (Robertson and Wexler, 1962). PAS +ve cyanophils in case of *C.striata* exhibit intense secretory activity as they display hypertrophy hyperplasia during pre-spawning season. The gonadotropic hormones secreted by these cells, are

utilised for final maturation of oocytes, as indicated by gradual, numerical decrease of gonadotropes. Studies on *Heteropneustes fossilis* (Sundraraj, 1959) and *Mystus vittatus* (Singh, 1970) have also indicated such correlation of PAS + ve cells with the maturation of gonads.

Present studies in *Channa striata* give a clear indication of pituitary-gonadal relationship during the reproductive cycle. Such studies, if performed on other commercial fishes, may prove useful in planning aquaculture projects.

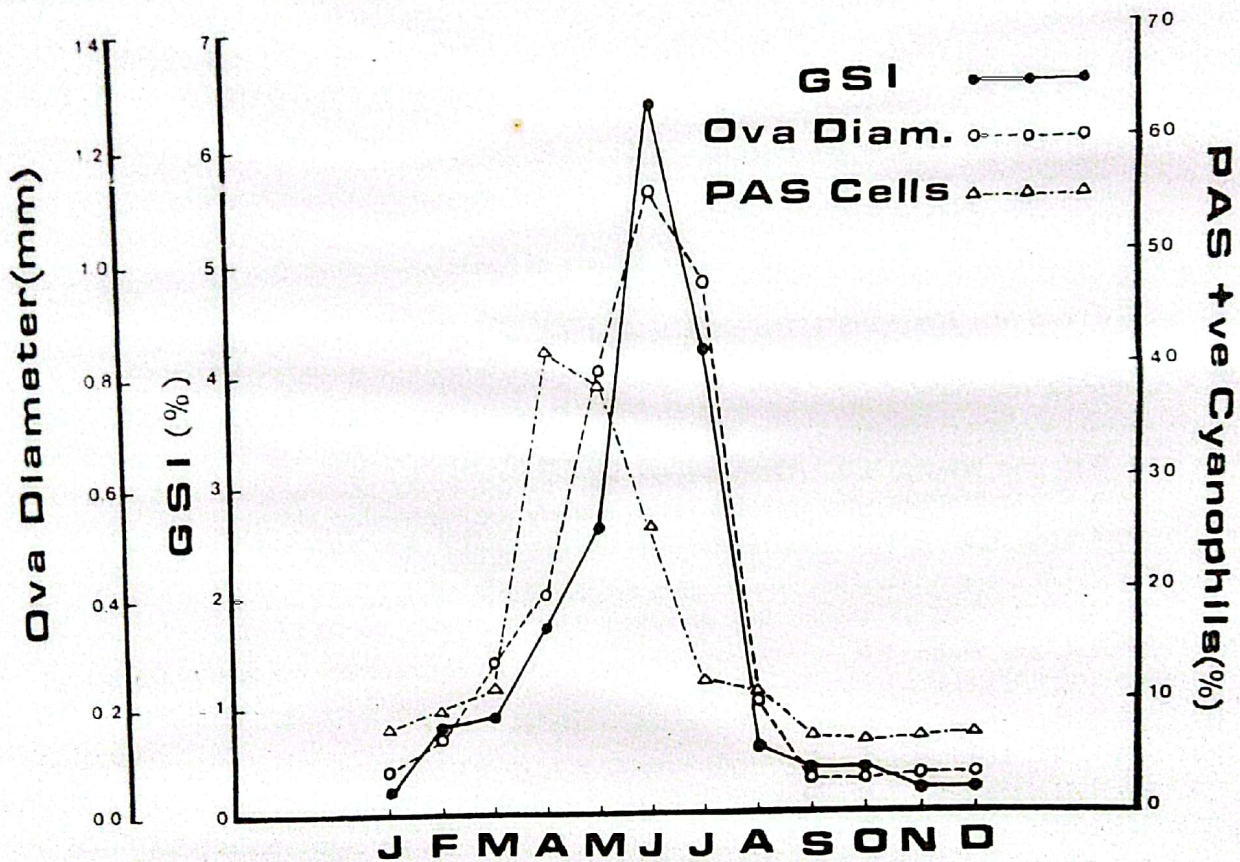


Fig: 1. Seasonal fluctuations of GSI, Ova diameter and PAS +ve cells of the pituitary in *Channa striata*.

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