



# Maturation and Spawning in Ribbon Fish *Lepturacanthus savala* (Cuvier, 1829) from Karwar Water, Karnataka, India

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## Abstract

The development of fisheries essentially depends upon the knowledge of the biology of the local fish in India. The success or failure of any fishery is largely dependent on the reproductive potential of the concerned species through its longevity in the biosphere. The information on the maturation cycles, spawning behavior, and size at maturity have very much importance in fishery management. Ribbon fish fishery has emerged as one of the leading pelagic fisheries on the west coast. Ribbon fish belongs to the family Trichiuridae. A total of nine species of Ribbon fish have been reported from Indian waters (Rizvi *et. al.* 2010). Among these *T. lepturus* and *L. savala* dominates in the Karwar waters. Those are mostly caught in trawl catches as side catch. During the present study, the Maturation and spawning aspects of ribbon fish *Lepturacanthus savala* were studied.

**Keywords:** *Lepturacanthus savala*, maturity, maturity stages, reproductive biology, spawning.

## Introduction

World fish and fisheries have always played an important role in food, nutrition, and livelihood. The marine fishery has a significant role in the social and economic development of India. Mainly two species of Ribbon fish, *Trichiurus lepturus* and *Lepturacanthus savala* contribute to the bulk landings at Karwar coast.

The Ribbon fish fishery is confined to the depth zone usually shallower than fifty meters (James, P.S.B.R., 1967). Ribbon fish shows a regular diurnal migration pattern, during the daytime they are found close to the bottom and at night

they ascend in the water column and get dispersed (Rao *et. al.*, 1977). Ribbon fish *L. savala* (Savali or Spiny hairtail) belongs to Class- Actinopterygii, Family- Trichiuridae (Reference-ITIS Data Access Taxonomic Serial number- 551146)

Studies on the various aspects of the reproductive biology of fish are useful for a better understanding of their annual stocks. Reproductive parameters such as maturation and spawning frequency help in fishery predictions and management. Various scientists have studied the reproductive biology of Ribbon fish, Day, F. (1865), on the fishes of Cochin on the

Malbar Coast; Prabhu (1955), on *T. haumela*; Dutt et. al. (1966), studied two new species of Trichiurids from Waltair; Gupta (1966), on two new species of Ribbon fishes of the genus *Trichiurus* (Linn.); James (1980), on spawning aspects, indicated that ovaries as an indicator in fishes. This study will considerably enhance the knowledge of fishery because the detailed study on the biology and fishery of *L. savala* at the Karwar coast is limited.

### Materials and Methods

**Study area-** Karwar is situated at 14° 48' 30" N and 74° 07' 42" E., from district Uttar Kannada, Karnataka state has a coastline of around 350 kilometers of which 144 kilometers, extends from Majali (North) and Bhatkal (South), endowed with rich marine resources. Karwar has Kali estuarine complex covered with huge mangrove areas and also has extensive shelves and slopes which provide feeding and breeding grounds for commercially important fish.

**Collection sites-** For a collection of fish two landing centers were selected, Baithkol (14° 80' 13" N and 74° 11' 58" E) and Majali (14° 90' N and 74° 10' E.). Baithkol is the extended part of landmass, depth of adjacent water is around nine meters where mainly trawl catch gets landed. The second collection center is Majali somewhat landlocked area where non-mechanized boats are being operated.

**Data gathering instruments-** The instruments used for data gathering were measuring tape, laminated graph paper, and fish measuring board as per requirements. Digital balance, a pair of dividers, dissection box, digital camera (Samsung/ Nikon), LeicaEC3 microscope

for capturing micro-photographs, and computer with peripherals and software.

### Sampling procedure and methodology-

The fresh specimens of Ribbon fish *Lepturacanthus savala* were collected monthly by random sampling method from Baithkol and Majali during the period December- 2011 to December- 2012 and studied for biological details. Specimens from the collection site to the laboratory were carried in a chill pack containing ice.

As soon as specimens were brought to the laboratory; they were blotted with blotting paper. The total length of each fish was measured from the tip of the lower jaw to the tip of the tail to the nearest mm; fish were weighed nearest to 0.1 grams by using a tabletop, electronic weighing balance, and sorted into different size groups. During the study period, a total of 631 specimens ranging from 100-630 were studied. Each fish was then cut open to record the sex, gonadal condition, and gonadal weight. Histopathology was done to note down gonadal changes. Ova diameter was also studied.

The stages of maturity of gonads were determined on the basis of the morphological appearance of gonads. Macroscopic (morphological) observations like color, shape, and size in relation to the body cavity as well as changes in the diameter of unspawned ova, and degree of yolk deposition were taken into consideration. Microscopic observations of gonadal products were based on materials preserved in 10% formaldehyde; by using the histological method.

### Results and Discussion

#### Reproductive organs-

**Female reproductive system:** The female reproductive system of *L. savala* consists

of a pair of ovaries, oviducts, and common

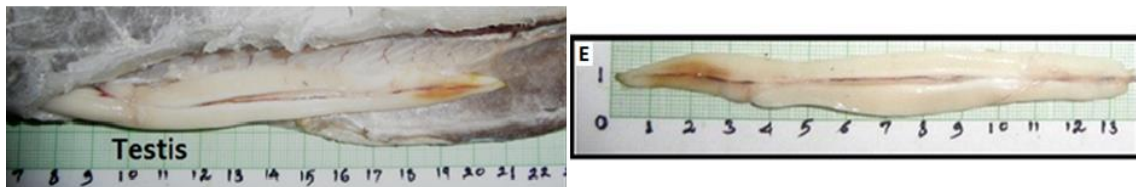
ovarian ducts (**Plate-I & II**).



**Plate-I & II: In situ and Ripe ovary of *L. Savala***

**Male reproductive system:** The male reproductive system consists of a pair of

elongated testes, vas deferens and common sperm duct (**Plate-III & IV**)



**Plate III & IV: In situ and mature testis of *L. Savala***

### Maturation and Spawning.

**1) Stages of maturity:** According to Qasim (1973), Maturation refers to cyclic morphological changes in the male and female gonads of the fish, which undergo to attain full growth and ripening. The majority of fish show cyclic or periodic reproductive behavior. In *L. savala* or any fish, for the determination of the maturity cycle, most commonly the stages of maturity of the gonads should be confirmed first. Workers engaged in research on the maturity and spawning conditions of fish have prepared different types of maturity scales according to the peculiarities present in the different fishes which were studied by them. During the present study, microscopic observations were made according to Susan K. & Brown-Peterson *et. al.* (2011).

*i). Classification of maturity stages of ovaries based upon morphological and microscopic observations in *L. savala* (Plate-V)*

**Stage -I. Immature ovary (never spawned):**

**Macroscopic observations** - Ovaries are small thread-like, transparent and have two small and clear lobes, and occupy about 1/3<sup>rd</sup> body cavity. Sex cannot be determined by gross examination. Ova was not visible to the naked eye.

**Microscopic observations (Histological features)** – Revealed that the ovarian wall is thin. Oocytes are compactly arranged with very little space between them. Primary-grown oocytes and oogonia are distinct. Blood vessels are not so clear. No atresia or muscle bundles were seen. The size of oocytes varied from 0.025 to 0.576 mm.

### Stage- II. Developing ovary:

#### *a. Maturing ovary (Virgin):*

**Macroscopic observations** – Ovaries are small translucent, slightly enlarged, white to pink in appearance and occupy more than 1/3 part of the body cavity. At this stage, granular oocytes have been observed.

**Microscopic observations (Histological features)** - Early developing cortical

alveolar oocytes (CA), primarily grown (PG), primary vitellogenic (Vtg. 1) and secondary vitellogenic (Vtg. 2) oocytes were seen. Blood vessels were more distinct, and some atresia and muscle bundles were present. Ova is with distinct nuclei; in some yolk deposition was started as a central semi-transparent portion while some were devoid of any yolk deposition. The size of oocytes varied from 0.045 to 0.718 mm.

**b. Recovered spent (The sexually mature but reproductively inactive or re-maturing stage after the spawning)**

**Macroscopic observations** - At this stage fish is resting or recovering. Ovaries become flaccid and condensed.

**Microscopic observations (Histological features)** - Blood vessels were more prominent. Few (Vtg. 1&2) oocytes and post-ovulatory follicular complex (POF) were found. Atresia was present.

**Stage- III. Mature or ripening:**

**Macroscopic observations-** Ovaries were large, orange-colored, fully developed, and extended almost in the entire body cavity. Ovaries were filled with numerous compactly arranged yellowish ova, in the ovigerous lamellae. Eggs were large and visible to the naked eye. At this stage, ovaries were capable of spawning.

**Microscopic observations (Histological features)** - Early stages of maturing oocytes and tertiary vitellogenic (Vtg. 3) oocytes were present. Blood vessels were prominent. At this stage, ova were fully yolked and opaque. The size of the ova varied from 0.315 to 1.374 mm.

**Stage- IV. Ripe ovary:**

**Macroscopic observations and microscopic observations**

- Free and large eggs, fully yolked and opaque. Those are ready for liberation. The size of the ova varied from 0.503 to 1.830 mm.

**Stage- V. Spent ovary:** During the present study, in *L. savala* partially and fully spent ovaries were seen. Partially spent ovary has occupied nearly half of the portion of the body cavity. Few residual eggs were observed at this stage. The fully spent ovaries were flabby and contracted. In the partially spent ovary, few yolky eggs were observed. Their size varied from 0.715 to 1.801mm.

**ii). Classification of maturity stages in the testis of L. savala: (Plate-VI)**

**Stage- I. Immature:** Testes were slender, transparent, and thread-like; occupied more or less 1/4<sup>th</sup> part of the body cavity. In the immature stage of the testis of *L. savala* spermatogonia and spermatocytes were seen at the periphery.

**Stage-II. Developing Testis/ Maturing Testis:** Testes were whitish and opaque, bilobed, and slightly enlarged; occupied 1/4<sup>th</sup> part of the body cavity. At this stage, blood capillaries, testicular lumen, and spermatogonia were prominent

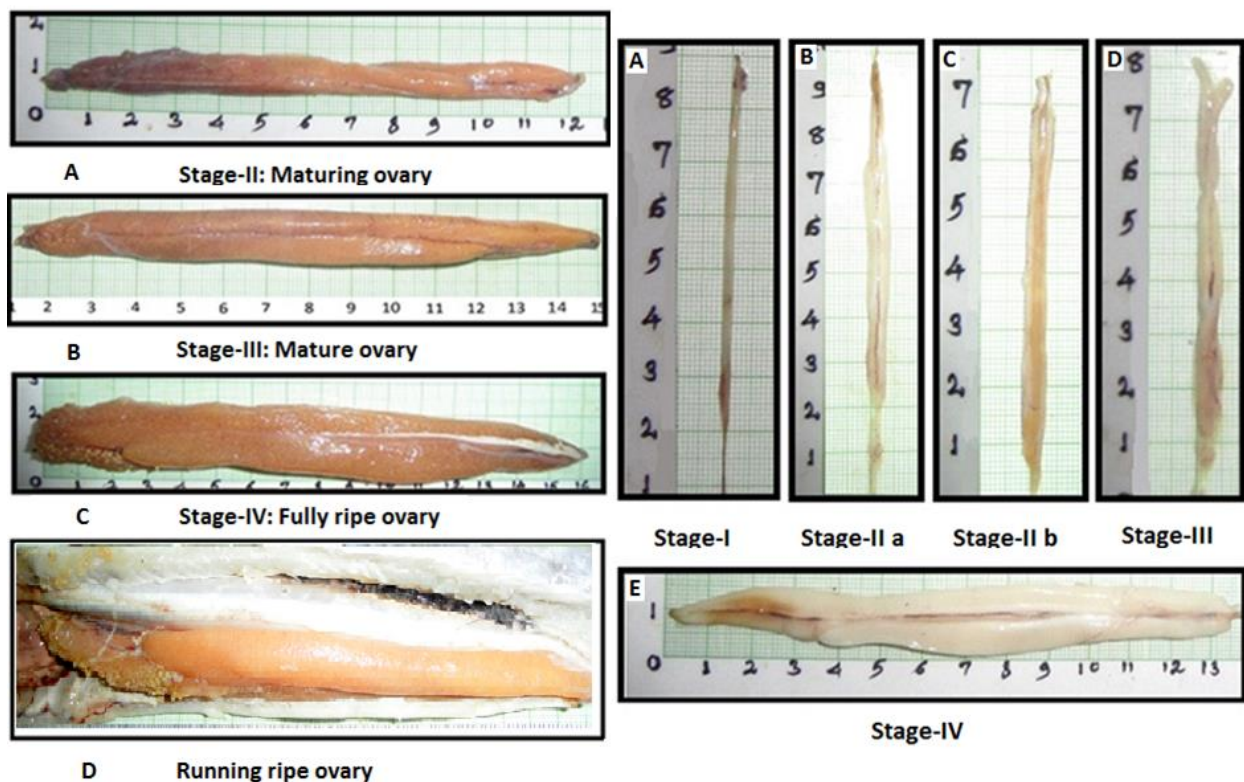
**Stage- III. Mature or ripening:** Testes were fleshy, greatly enlarged, and exude milt on the application of slight pressure on the abdomen of the fish. In the V. S. mature testis were with full of mature sperm bundles

**Stage- IV. Ripe:** Testes were milky white and occupied about 3/4<sup>th</sup> length of the body cavity. In some male fish testes were full of sperm bundles that were ready to release

**Stage- V. Spent:** Testes were loose and shrunken.

One year of data can give an idea about the maturation cycle. The ICES has recognized seven stages of maturity, 1<sup>st</sup> and 2<sup>nd</sup> as immature, 3<sup>rd</sup> and 4<sup>th</sup> as maturing, 5<sup>th</sup> as mature, 6<sup>th</sup> as ripe, and 7<sup>th</sup> as spent (Wood, 1930). Qasim (1973), views that in tropical and subtropical fish, the number of maturity stages should be limited to five 1<sup>st</sup> as immature virgin, 2<sup>nd</sup> maturing virgin or recovered spent, 3<sup>rd</sup> ripening, 4<sup>th</sup> ripe, and 5<sup>th</sup> spent. These five stages of maturity are similar to the

standard laid down by ICES which was followed by Lovern and Wood in 1937. Prabhu (1955), in *T. haumela* and Radhakrishnan (1957), in *Sillago sihama* have given five stages of maturity. Qasim (1973), views that in tropical and subtropical fish, the number of maturity stages should be limited to five 1<sup>st</sup> as an immature virgin, 2<sup>nd</sup> maturing virgin or recovered spent, 3<sup>rd</sup> ripening, 4<sup>th</sup> ripe, and 5<sup>th</sup> spent.



**Plate- V & VI: Ovaries and Testis showing various stages of maturity in *L. Savala***

**Conclusion-** The study of maturation and spawning provides baseline information about the standing crop of *L. savala*.

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