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Shahina S

Department of Studies in Marine
Biology, Karnatak University
Dharwad's, Post Graduate
Centre, Kodibag, Karwar,
Karnataka, India

Shivakumar H

Department of Studies in Marine
Biology, Karnatak University
Dharwad's, Post Graduate
Centre, Kodibag, Karwar,
Karnataka, India

Reproductive life of the Indian Mackerel *Rastrelliger kanagartha* (Cuvier 1817) in Uttara Kannada coast, Karnataka, West coast of India

Shahina S and Shivakumar H

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Abstract

The investigation on the reproductive life of the Indian Mackerel, *Rastrelliger kanagartha* (Cuvier 1817) in the Uttara Kannada coast for a period of 13 months was performed from Jan 2018 to Jan 2019. A total of 1299 fishes were dissected for entire period and their biological parameters were investigated. Of these total fishes, 734 fishes were female, 435 were male and 130 were indeterminate. Throughout the year the fishery was present with copiousness in pre-monsoon and post-monsoon period. Significantly the length and total weight of Indian Mackerel, *Rastrelliger kanagartha* was found to be linear and the Pearson's correlation was 0.913 ($p < 0.005$). (Bervian *et al.*, 2006, Fontoura *et al.* 2010) found that mooting the fishes can change its growth pattern during its life span and many authors sign it a mark of reproductive intricacy. The total body weight, the gonad weight and the fecundity was at its peak in the monsoon period and the maximum length was observed in the pre monsoon period. By using cumulative frequency method L_m was found to be 16.65 cms for males and 17.85 for females in Indian mackerel *Rastrelliger kanagartha*. The intent of the present work is to built a relationship between length and weight in relation to the size of first maturity of Indian Mackerel *Rastrelliger kanagartha* also classifying of developmental stages of the gonads and predicting the GSI.

Keywords: Indian mackerel, biology, gonads, maturation, fecundity, GSI

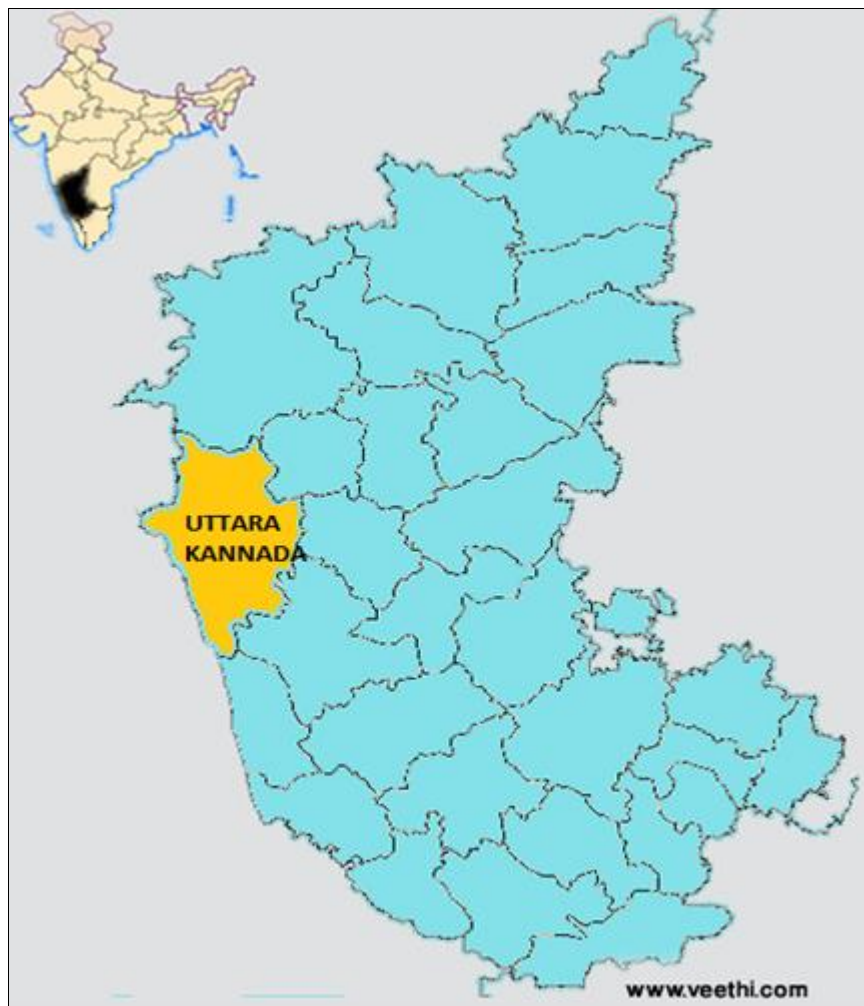
1. Introduction

Indian Mackerel enjoys wide distribution in Indian waters especially in West Coast of India and has a very good food demand as sea food. The emergence of this species as a major fishery in last decade has attracted the attention of researchers. According to CMFRI Annual report 2018-2019 the marine fish production was estimated at 3.49 million tonnes in 2018, recording a 9% decrease in comparison to the year 2017 and this was because of the steep decline in the production of the Indian oil sardine *Sardinella longiceps* which dropped from 1st to the 9th position and a decline of 54% in the landings at 1.55 lakh tonnes. Hence the Indian mackerel contributed 2.84 lakh tones. Popularly Karnataka is generally known as the "Mackerel Coast" contributing nearly about 4.52 lakh tons (13%) and ranked 4th position. The centre value of marine fish landings in Karnataka was 6,442 crores. The Indian mackerel *Rastrelliger kanagartha* with a contribution of 2.84 lakh tones became a major resource though it reduced by 1.4% compared to the previous year. And Uttara Kannada made its share by 12.48%. Uttara Kannada has 13 fish landing centres i.e., Karwar (Karwar, Majali & Amdalli), Ankola (Harawada & Keni), Kumta (Kumta, Gangavali & Tadadi), Honnavar (Honnavar, Manki) and Bhatkal (Bhatkal, Murdeshwar & Shirali).

Corresponding Author:

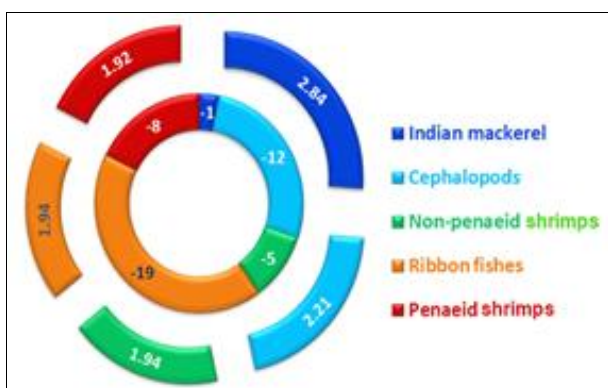
Shahina S

Department of Studies in Marine
Biology, Karnatak University
Dharwad's, Post Graduate
Centre, Kodibag, Karwar,
Karnataka, India



Site Map

Uttara Kannada district lies between 13.9220° N to 15.5252° N latitude and 74.0852° E to 75.0999° E longitude and extends to an area of 10,291 km². It covers from north south to a maximum of 180 km, and from west to east a maximum width of 110 km.



Materials and Method

As per the availability, the samples of Indian mackerel *Rastrelliger kanagurta* were collected from mechanized, non-mechanised and traditional gears and crafts weekly between Jan 2018 to Jan 2019 from the Uttara Kannada fish landing centres. Then the fishes were brought to the laboratory. With the aid of measuring board and thread the total length was measured to the nearest millimeter and the total body weight was weighed to the nearest milligram with the help of digital balance and further recorded. Then the fish was eviscerated

and the condition of gonads, their colour, the maturity stages and position was noted (Pradhan and Palekar, 1956) [8] and later the gonads were carefully detached with the help of forceps, their weight was recorded and further fecundity were investigated by the method given by Ganga U (2010) [5]. The total fecundity was estimated by gravimetric method Wayan Kantun (2018) [7]. A subsample was taken of 0.01 g of total gonad weight and calculated using following formula:

$$F = \frac{Q}{q} \times n$$

Where: F = total fecundity;
 Q = total gonad weight (g);
 q = gonad subsample weight (g);
 n = number of eggs in gonad subsample.

Data analysis

The data collected was computed and statistically analyzed using Microsoft Excel 2010. Further, GSI was determined by the method given by Shrinivas H Hulkoti *et al.*, (2013) [6],

$$GSI = \frac{\text{Gonad weight (g)}}{\text{Total body weight (g)}} \times 100$$

Results

When the values of fish length and fish weight were plotted, a scatter plot, it showed a linear relationship between the fish length and fish body weight. The correlation co-efficient *r*

between length and weight of a male fish was 0.847. Similarly the correlation co-efficient r value between length and weight

of a female fish was 0.871.

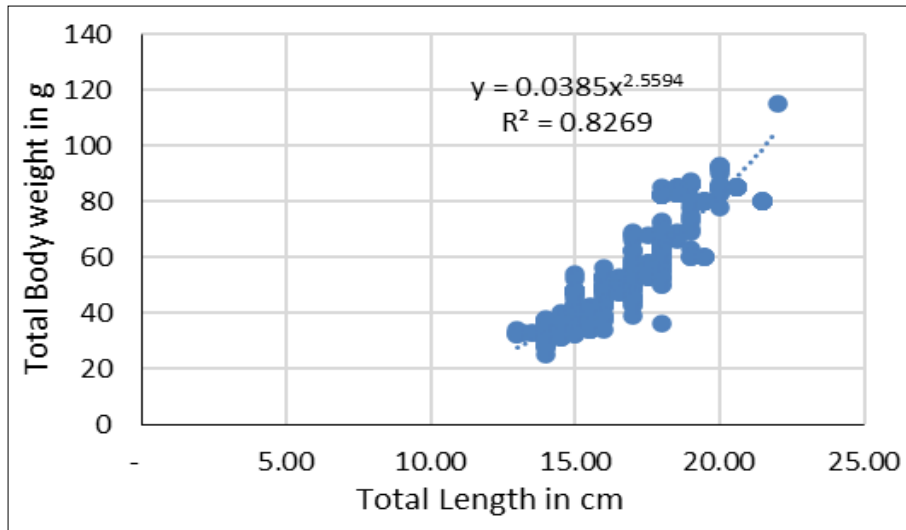


Fig 1: Scatter plot: Male fish Length weight relationship

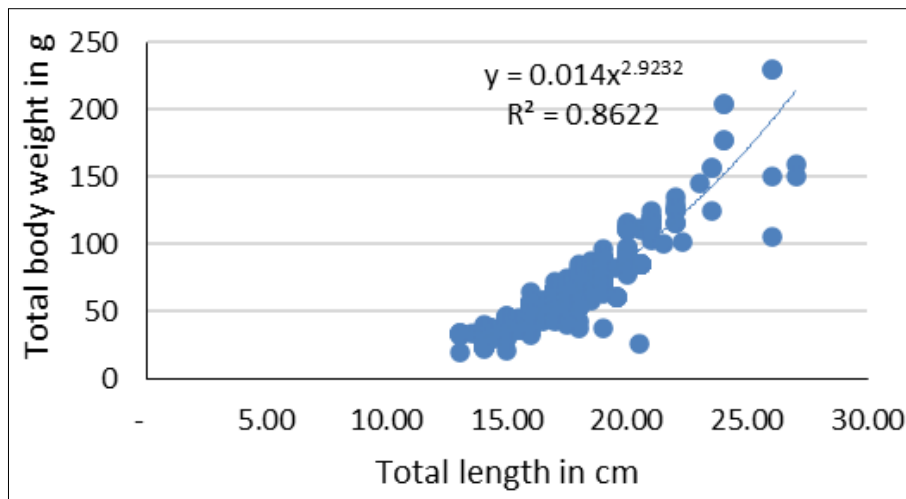
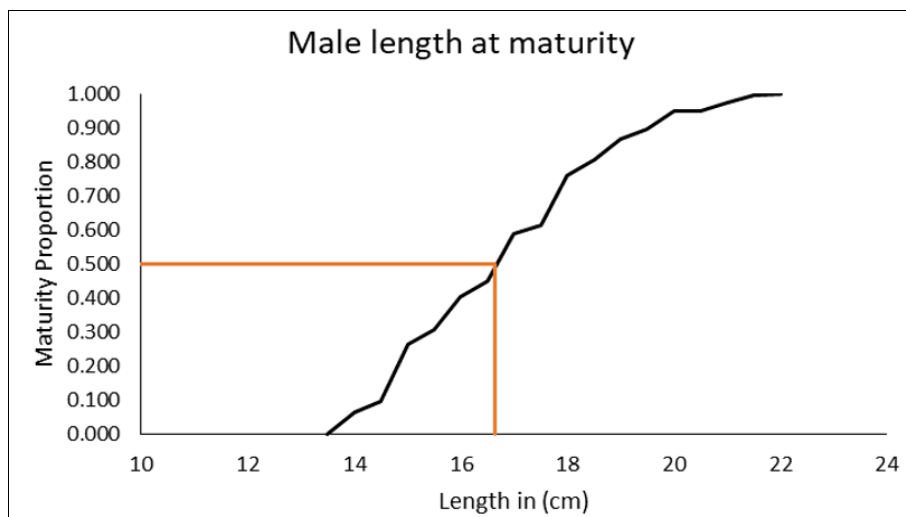


Fig 2: Scatter plot: Female fish Length weight relationship

Length at first maturity: L_{50} of female Indian mackerel was estimated to be 17.85 cms and for male was 16.65 cms. Spawning in Indian mackerel, *Rastrelliger kanagurta* was sustained with gravid ripe gonads throughout the study period. Spawning was maximum in the monsoon season

followed by the pre monsoon season. The fecundity was high in the post monsoon period followed by the pre monsoon period. The GSI was uttermost in pre monsoon succeeded by monsoon and post monsoon period.



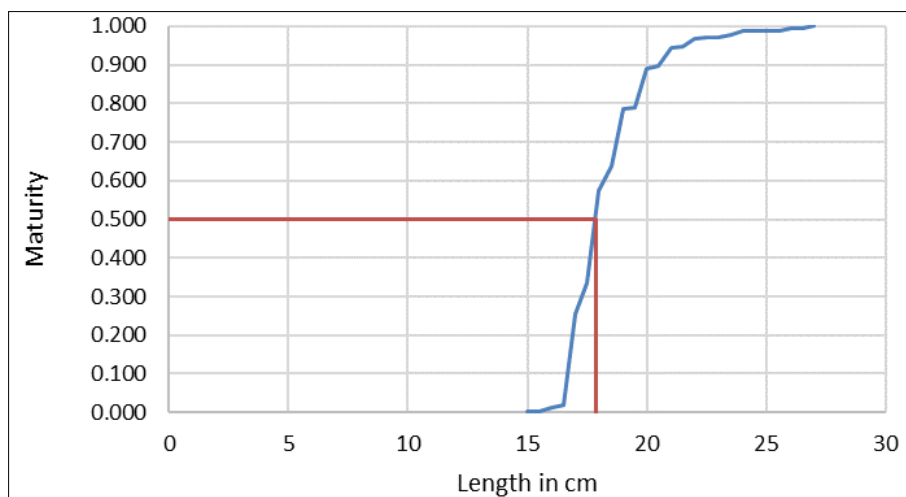


Fig 3: Length at first maturity L_{50} for male / Length at first maturity L_{50} for female

Pre monsoon

Throughout this period Matured (stage V and VI) contributed 50%. The ripe fishes were also a part of this catch in this season. But the indeterminate dominated in entire pre monsoon period.

Monsoon

Overall the indeterminate fishes dominated in the monsoon period i:e June, July, August, September. This season witnessed matured and ripe fishes. But the catch also witnessed equally fully spent (II b) stage.

Post monsoon

The month of November dominated with the ripe fishes and was followed by the October month. The partially spent fishes (VII b) were found only at the beginning of the post monsoon (October). The immature fishes had an ascending pattern in this period. The fully spent (II b) stage dominated in the month of January. The indeterminate stage were also common throughout this period. The fecundity was highest in the monsoon period and was surveilled by pre monsoon and post monsoon seasons.

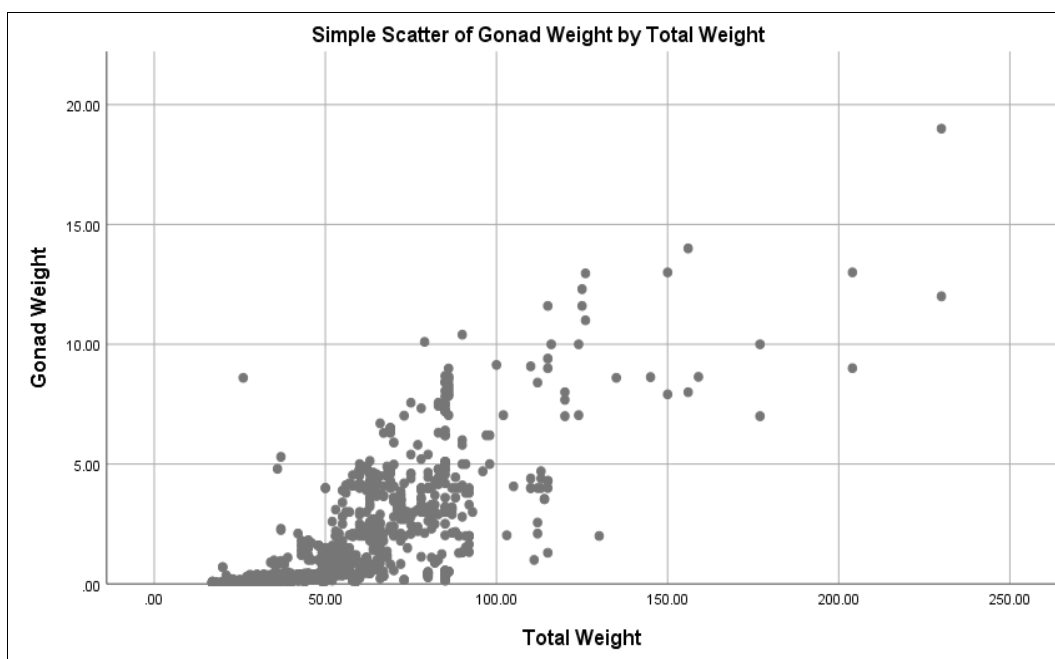


Fig 4: Simple scatter of Gonad weight by Total weight for male

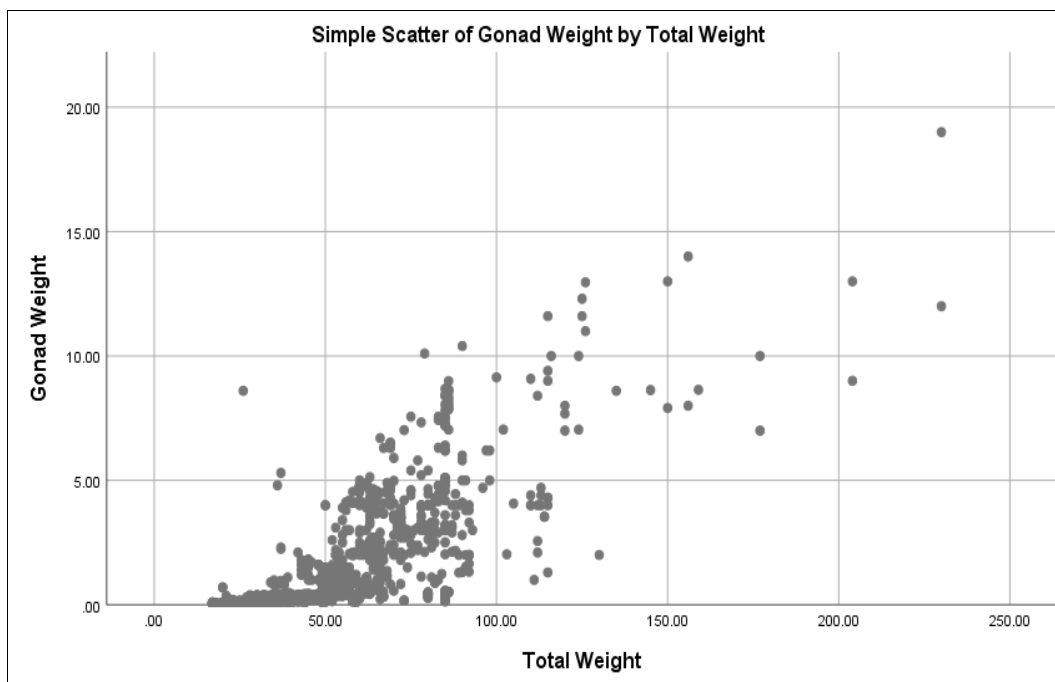


Fig 5: Simple scatter of Gonad weight by Total weight for female

The simple scatter diagram shows that for both males and females, as the gonad weight increases the body weight also increases of Indian mackerel *Rastrelliger kanagartha*. The fecundity was highest in the monsoon period and the highest number of eggs ranging in between 12,180 eggs to 2,13,658 eggs followed by pre monsoon and post monsoon period. During the analysis of Indian mackerel 17gm weight was minimum and the maximum weight was 230gm and the minimum total length was 12cm and the maximum length was 27cm and the gonad minimum weight was 0.03mg and a maximum weight of 19gm. The number of eggs increased with increase of total length and total weight of the body. While Antony Raja and Bande (1972) [2] estimated 37,200 eggs in *Rastrelliger ka nagurta*. (Bhendarkar *et al.*, 2018) [9] found the absolute frequency ranged between 55,264 to 3,24,568 eggs with an average of 1,08,266 and (Rao,2009) 20,911 to

1,11,000 eggs and 39,600 to 73,781 eggs (Pillai, 2009) [11] and Abdussamad *et al.*, (2010) [1] 68,500 eggs, Hulkoti *et al.*, (2013) [6] 86,744 to 94,376 eggs, Arralfi *et al.*, (2016) – 24,542 to 1,23,760 eggs. Fecundity estimates of mackerel in earlier studies range (Devanesan and John, 1940) [4] found 94,000 eggs. But (Sekharan, 1958; Yo-hannan and Abdurahiman, 1998) [12] and several researchers felt that fecundity of mackerel is much higher than these reports. Pillai *et al.* (2009) [11] reported that the fecundity of *Rastrelliger kanagartha* ranged from 39,600 eggs to 73,781. The calculated fecundity of Indian mackerel in Tuticorin coast by Abdussamad *et al.* (2010) [1] was 68,500 eggs. The recent study by Hulkoti *et al.* (2013) [6] obtained fecundity between 86,744 and 94,376 eggs. In 2016 (Arrafi *et al.*, 2016) [3] counted the fecundity of *R. kanagartha* varied from 28,542 to 123,760 eggs.

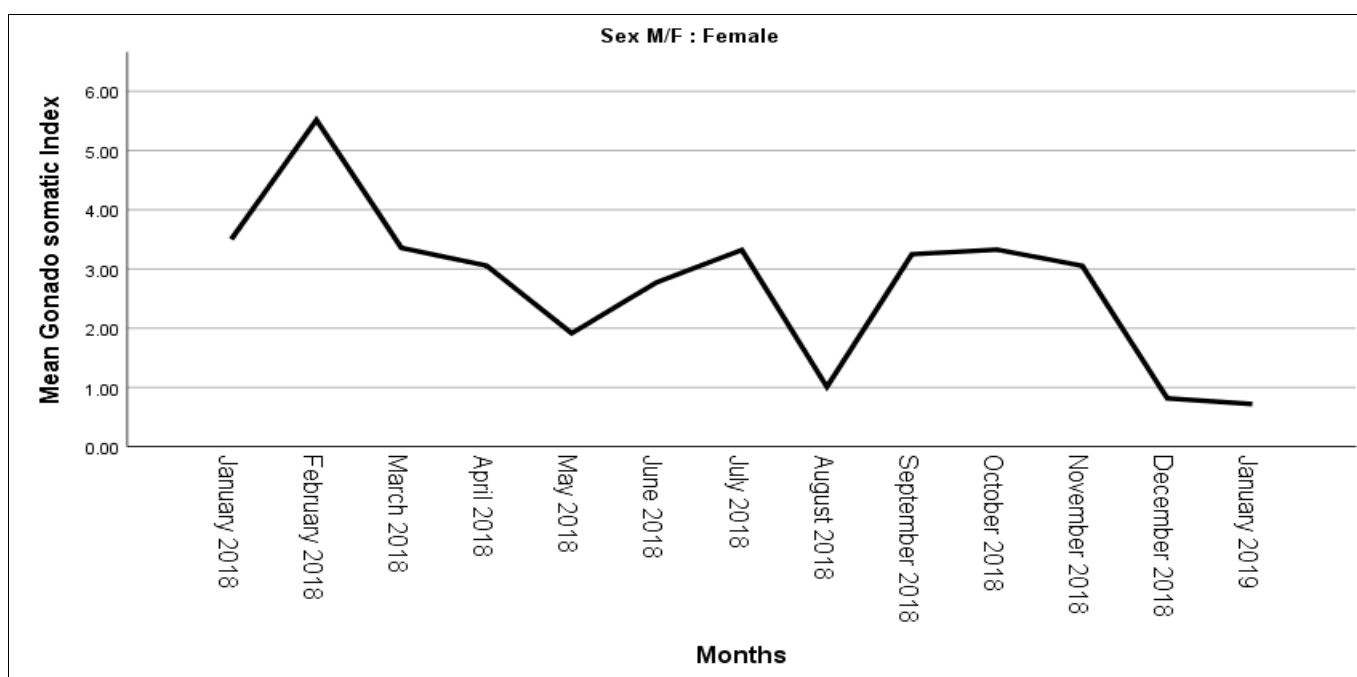


Fig 6: Simple line mean of gonado somatic index by months

The GSI of *Rastrelliger kanagurta* showed a highest peak during the pre-monsoon period i.e. in the month of February and then followed by monsoon and post monsoon period. The lowest GSI was recorded in the August month of monsoon period and in the month of January in the post monsoon period. *Rastrelliger kanagurta* showed increasing trend of GSI from immature to matured gonads. The partially spent, fully spent and resting fishes had low GSI as these gonads were low in weight.

Discussion

Indian mackerel, *Rastrelliger kanagurta* is one of the most relishing table fish of all the communities as it is a great source of omega 3 fatty acids. Hence fame of piscary ascertains the marine fishery is a playscript of the state. There are no recent investigations being carried on Indian mackerel, *Rastrelliger kanagurta* As divulged in the present study spawning was vivid during the monsoon and had maximum ripe gonads. Active spawning was a voice of monsoon season. Enceinte exploitation of spawners during the vizor catamenia should be properly channeled. The female were comparatively higher in number compared to the male. The matured ripe gonads occupied the full body cavity with their stomach being 1/4th full or empty, which indicated that there is a minimum feeding during the reproductive and spawning period.

Conclusion

The present study emphasized that the spawning of Indian mackerel resulted throughout the year and it also highlighted that the peak spawning season occurred in pre-monsoon and monsoon season (April-June) and a minimum peak occurred (October-November). Hence the new recruits result from April and November along the Uttara Kannada coast, Karnataka.

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