Observation on the Gonado-Somatic Index-GSI and Hepato-Somatic Index-HSI of *Decapterus russelli* Mangaluru coast

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Abstract:
Gonado-Somatic Index (GSI) and Hepato-Somatic Index (HSI) were analyzed based on body weight and organ weight of the fish. A total of 339 females of Indian scad, *Decapterus russelli* were fortnightly collected from fish landing center Mangaluru to determine seasonal changes in GSI and HSI condition. The GSI values ranged between 0.7674 to 2.1427 in male fish. In case of female, the GSI values fluctuated between 0.7491 to 3.7267. The HSI values ranged from 1.0060 to 1.5252 in male fish and in female, the HSI values fluctuated from 1.0295 to 1.7822.

Keywords: *Decapterus russelli*, Gonado-Somatic Index, Hepato-Somatic Index.

Introduction
The Indian scad, *Decapterus russelli* is included under carangidae family. The details available on GSI and HIS of this species scanty and hence attempt is made to study the Gonado-Somatic Index (GSI) (ovary and testis) and Hepato-Somatic Index (HSI) of this species.

In the present study GSI of male and female fish was calculated simultaneously. At maturity stage fish had maximum GSI value and after spawning GSI value declined. The GSI value also related to amount of food available and water temperature. GSI in the ratio of fish gonad weight to body weight, it is particularly helpful in identifying spawning season.

Hepato-Somatic Index of *D. russelli* was also calculated out simultaneously. HSI is associated with the liver energetic reserves and metabolic activity. HSI values increased when the food available was plenty and conditions were favourable and the daily weight of the body was related to the increase in the HSI value and it was also observed that HSI also depends upon seasonal cycle. As liver is vital organ in the body and it performs various physiological functions, so its healthy condition is essential for growth of fish. As weight of body increases weight of liver also increases. The HSI gives us information about the condition of liver and body and also about the impact of water pollution on it. HSI also provides an indication on status of energy reserve in fish. In poor environment fish usually have a smaller liver with less energy reserves in the liver. HSI has been reported to decrease in fish exposed to water pollution. HSI value also provides us information about the healthy condition of fish and also about the quality of water, because higher HSI value means fishes are growing rapidly and have a good aquatic environment and if HSI value is less it means fish is not growing well and it is facing unhealthy environmental problems. While some authors (Pyle *et al.* 2005 and Sloof *et al.*1983) claimed that HSI might be useful as an indicator of chemical water pollution, others showed that it was inconsistent as a biomarker (Khan, 1999) and that it is dependent on the seasonal cycle (Yang and Baumann, 2006). Prior to establishment of HSI as a pollution indicator, standard ranges should first be established, and the possible effects of internal biological rhythms and environmental factors on this parameter must be assessed (Lenhardt, 1992).

Materials and Methods
Fish samples of *D. russelli* were collected from fish landing center, Mangaluru. For the calculation of HSI and GSI individual fish were sampled randomly in each month during the study period from August, 2015 to May, 2016. Fish samples were brought to the laboratory and they were moisture removed by blotting paper and there body weights were recorded to the nearest gram respectively. After weighing, fish were dissected to remove the liver and gonads from them for the calculation of HSI and GSI. Moisture of the liver and gonads was removed with the help of blotting paper and then weight of liver and gonads was recorded in grams. The Hepato-Somatic Index of the fish was calculated by the use of equation cited by Sulistyso *et al.* (2000).

\[
\text{HSI} = \frac{\text{Liver weight} \times 100}{\text{Fish Weight}}
\]

For calculating the Gonado - somatic Index, the weight of the individual fish was noted and the gonads were removed carefully and weighed in an electronic after removing the excess moisture using a blotting paper. (James, 1967; Baragi, 1977). The Gonado – Somatic Index was calculated using the formula.

\[
\text{GSI=} \frac{\text{Gonad weight} \times 100}{\text{Fish weight}}
\]

The average GSI values were plotted against months.

Results and discussion
Gonado- Somatic Index
In this study, both male and female were taken into consideration separately. The Gonado-Somatic Index (GSI) was calculated for each individual fish and was averaged for each month. The average GSI values were plotted against each month and the results are presented in Fig.1. Monthly changes in GSI for male and female were noticed during the study period. The GSI values ranged
between 0.7674 to 2.1427 in male fish. The lowest GSI value was recorded in April, while the highest in October. The GSI values gradually increased from August to October and declined in the month of November and December, thereafter the GSI values increased in the months of January and February. During March and April GSI values decreased followed by an increase in the month of May.

In case of female, the GSI values fluctuated between 0.7491 to 3.7267. The lowest value of GSI was recorded in the month of January, while the highest was recorded in the month of October indicating the occurrence of maximum number of mature fish during winter months. In December GSI values was high (1.8237) followed by a sudden decline in January (0.7491) and again increase in GSI was noticed in February. In March GSI values slightly increased and then suddenly declined in the month of April and May.

Delsman (1926), Tiews (1958) and Tiews et al. (1975) observed prolonged spawning period for Decapterus sp. from Java Sea and Manila Bay. In the Indian waters, Sreenivasan (1981) reported prolonged spawning for D. dayi extending from February to November with peak during February and March. Raje (1997) reported November to May as the spawning season. Reuben et al. (1992) were of the view that December and August is the peak spawning period for this species from Northwest coast of India. Murty (1991) documented December to August as spawning period in Kakinada waters while in Vizhinjam waters it spawned during March to May. Balasubramaninan and Natrajan (2000) reported November and December and Manojkumar (2007) reported March to December as the spawning period from Malabar.

Different workers reported different spawning period which were overlapping. This suggests that as the species is a continuous spawner and though the ovary may be ripe, they spawn only when the conditions are favourable. However favourable conditions may vary from place to place depending upon the prevailing environmental conditions of the given area. This may be the reason for the differences in the spawning period reported by various workers.

Hepato-somatic index (HSI)

In this study, both male and female were taken into consideration separately. The Hepato-Somatic Index (HSI) was calculated for each individual fish and was averaged for each month.

The average HSI values were plotted against each month and results are presented in Fig. 2. Monthly changes in HSI for male and female were noticed during the study period. The HSI values ranged from 1.0060 to 1.5252 in male fish. The highest HSI value was recorded in the month of April, while the lowest value was in the month of January. Maximum value of HSI was recorded in April indicating the occurrence of more fat in the liver during summer months.

In case of female, the HSI values fluctuated from 1.0295 to 1.7822. The maximum value was noticed in the month of October and it gradually decreased to reach lowest value in the month of December and thereafter increased. Maximum value of HSI was recorded in October indicating the occurrence of more fat in the liver during winter months. Because of seasonal fluctuations in food and feeding and gonadal development the Hepato-Somatic-Index may be varying.

The health of fish is directly related to the condition of liver because it is the organ related with the digestion of food and storage of reserved food. So the good condition of the liver is the indication of the good health of fish. Similarly the good and healthy condition of the gonads is the indication of maturity of fish for the breeding season.
In this study, both male and female were taken into consideration separately. The Hepato-Somatic Index (HSI) was calculated for each individual fish and was averaged size wise.

The average HSI values were plotted against size and results are presented in Fig. 3. Size wise changes in HSI for male and female was noticed during the study period. The HSI values ranged from 1.0071 to 1.7510 in male fish. The highest HSI value was recorded in the size group of 10-12 cm, while the lowest values was in size group of 20-24 cm.

In case of female, the HSI values fluctuated from 0.9336 to 1.5008. The maximum value was noticed in the size group of 20-22 cm, HSI was increased compared to previous size group. Minimum value was noticed in the size group of 22-24 cm.

Fig. 2: Monthly variation in the Hepato-Somatic Index

Fig. 3: Size wise variation in the Hepato-Somatic Index

References


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